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THE MONETARY TRANSMISSION MECHANISM
IN SRI LANKA 1977-1985

A Macro Simulation Approach to the Modelling of
the Money Supply Process and the Construction of
an Analytical Framework for Monetary Management

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ABSTRACT

THE MONETARY TRANSMISSION MECHANISM IN SRI LANKA 1977-1985

BY

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KEYWORDS

MONETARY, TRANSMISSION, MECHANISM, POLICY, FORMULATION, INCOME, ECONOMY, AGGREGATES, INFLATION, SIMULATION

The primary objective of this thesis is to analyse the relationship between money and the macro-economy in Sri Lanka between 1977 and 1985, in order to identify the paths through which monetary policy impulses are transmitted over this period. In doing so, we also hope to highlight the use of macro-simulation as a tool for the analysis of the monetary transmission mechanism and to emphasise the importance of formulating monetary policy within an explicit monetary control framework. This is especially important in Sri Lanka since monetary policy has been a key instrument of demand management since 1977 and historically there has been a noticeable absence of an explicit monetary control framework.

Empirical research on the monetary transmission mechanism has been very limited as far as developing countries are concerned. An exception here is the SEACEN (1981) study which simulates the effects of monetary shocks on a number of South East Asian countries, including Sri Lanka, using a flexible monetarist approach. Our research is based upon a revision of the specification of this model for Sri Lanka and a more comprehensive disaggregation of the monetary transmission channels.

Our empirical model produces statistical results which are generally acceptable and conform to a priori expectations. This model is then simulated dynamically, both, to validate the equations in the context of a complete model and to quantify the impact of alternative policy scenarios relating to the monetary transmission mechanism in Sri Lanka.

We believe that our results will help to shed light on the nature of the monetary transmission mechanism in developing countries as well as provide the basis for an on-going analysis of monetary management in Sri Lanka.

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ABBREVIATIONS

A.I.C.C	=	Agricultural and Investment Credit Corporation
b.m.m	=	Broad Money Multiplier
B.O.P	=	Balance of Payments
B.R	=	Bank Rate
B.S.B	=	Borrowed Source Base
C.A	=	Conventional Approach
C.B	=	Central Bank
C.B.A	=	Central Bank Approach
C.B.S	=	Central Bank Securities
C.B.S.R	=	Central Bank Securities Rate
C.C.P.I	=	Colombo Consumers' Price Index
C.Ds	=	Certificates of Deposits
C.M	=	Capital Market
c.m	=	Credit Multiplier
C.R	=	Credit Rationing
C.R.C	=	Credit Rationing Channel
C.R.E	=	Credit Rationing Effect
D.C	=	Domestic Credit
D.Cs	=	Developed Countries
D.F.C.C	=	Development Finance Corporation Of Ceylon
D.O.I	=	Deposits of Other Institutions
E.F.F	=	Extended Fund Facility
F.C.B.U	=	Foreign Currency Banking Units
F.C.Ms	=	Formal Credit Markets
F.Cs	=	Finance Companies
F.D	=	Financial Disintermediation
F.E.E.C.S	=	Foreign Exchange Entitlement Certificate System
F.I	=	Financial Innovation
F.T.Z	=	Free Trade Zone
G.C.B	=	Gross Credit to Commercial Banks
G.D.P	=	Gross Domestic Product
G.N.P	=	Gross National Product
GOECD	=	Growth of OECD Countries
G.S	=	Government Securities
G.S.A	=	Gurley And Shaw Approach
G.S.R	=	Government Securities Rate
I.B.C.M	=	Inter Bank Call Money Market
I.C.Ms	=	Informal Credit Markets
I.E	=	Interest Elasticity
I.M.F	=	International Monetary Fund
I.R.S	=	Interest Rebate Scheme
I.T.Bs	=	Internal Trade Bills
I.Ts	=	Intermediate Targets
L.D.Cs	=	Less Developed Countries
L.S.D	=	Lump Sum Depreciation
M.A	=	Monetary Approach
M.A.B.P	=	Monetary Approach to Balance of Payments
M.A.U	=	Monetary Authority

M.B	=	Monetary Base
M.C.F	=	Monetary Control Framework
M.L.A	=	Monetary Law Act
M.L.C.F	=	Medium and Long Term Credit Fund
M.L.T.L.I	=	Medium and Long Term Lending Institutions
m.m	=	Money Multiplier
M.R.Rs	=	Marginal Reserve Requirements
M.S	=	Money Stock
M.S.Ms	=	Macro Simulation Models
M.T.Cs	=	Monetary Transmission Channels
M.T.M	=	Monetary Transmission Mechanism
M2	=	Broad Money
N.C.G	=	Net Credit to Government
N.C.P	=	National Credit Plan
N.D.A	=	Net Domestic Assets
N.D.B	=	National Development Bank
N.F.A	=	Net Foreign Assets
N.F.A.C.B	=	Net Foreign Assets of the Central Bank
n.m.m	=	Narrow Money Multiplier
N.Q.T	=	Non-Quantity Theorists
N.Q.T.Ms	=	Non Quantity Theory Monetarists
N.R.F.C.S	=	Non Resident Foreign Currency Scheme
N.S	=	New Structuralists
N.S.B	=	National Savings Bank
N.S.S.B	=	Non-Borrowed Source Base
O.L.S	=	Ordinary Least Squares
O.M.O	=	Open Market Operations
O.Ts	=	Operating Targets
P.Ds	=	Private Debentures
P.Rs	=	Penal Rates
Q.T.Ms	=	Quantity Theory Monetarists
R.E.H	=	Rational Expectations Theory
R.M	=	Reserve Money
R.M.S.E	=	Root Mean Square Error
R.M.S.P.E	=	Root Mean Square Percentage Error
R.R	=	Required Reserves
R.R.D.Bs	=	Regional Rural Development Banks
RST	=	Rate of Interest
S.B	=	Source Base
S.C.Cs	=	Selective Credit Controls
S.E	=	Substitution Effect
SEACEN	=	South East Asian Central Banks Research and Training Centre
S.L.E.C.I.C	=	Sri Lanka Export Credit Guarantee Corporation
S.M	=	Share Market
S.M.I.B	=	State Mortgage and Investment Bank
S.R.Rs	=	Statutory Reserve Requirements
S.T.B	=	Secondary Treasury Bills
S.T.B.M	=	Secondary Treasury Bills Market
2.S.L.S	=	Two Stage Least Squares
2.S.L.S.P.C	=	Two Stage Least Squares Principal Components

T.B.R	=	Treasury Bill Rate
U	=	Theil's Inequality Coefficient
U.B	=	Use Base
U.Ts	=	Ultimate Targets
W.C	=	Wealth Channel
W.E	=	Wealth Effect
XPFXPC	=	Relative Price of Exports
ZXY	=	Lending Rate (Inter - Bank Call Money Market Rate)

CHAPTER 1

INTRODUCTION

1.1 Objectives of the Thesis.

Money's traditional role as the medium of exchange and store of value remains important in both developed (DCs) and developing countries (LDCs). However, money's relationship with the macro economy and its function as a channel for transmitting monetary impulses to other sectors of the economy is also essential to the analysis of its contribution to economic activity. This view of the relationship between money, monetary policy and macro economic activity has become more central to economic policy formulation in recent years and the emphasis on this aspect has been further strengthened by theoretical and empirical work in this area.

The main objectives of this thesis are three - fold. The first is to provide an understanding of the underlying relationships between money, monetary policy and the rest of the economy and to assess the dynamic paths through which money feeds into the system (the transmission mechanism or the money supply process). In general, interest rates, credit availability, wealth, portfolio changes and the money supply are considered to be the main channels of the monetary transmission mechanism (MTM). Although there is ample research in this area in DCs it is limited in

LDCs. In this regard we consider that explicit modelling of money's relationship with other macro economic variables is essential and to support our analysis we present a simple econometric model of the Sri Lankan economy which focuses upon the monetary transmission channels (MTCs).

A second objective is to formulate a monetary control framework (MCF) which assembles theoretical concepts, and institutional factors relevant to LDCs, such as Sri Lanka and the empirical relationships from our macro econometric model. So far Sri Lanka does not have any form of MCF and we intend to provide some guidelines with regard to the formulation of a MCF. We highlight necessary conditions for an MCF within which the consequences of using alternative transmission channels can be assessed. The criteria for the selection of appropriate channels and the relevant policy instruments will be supported by a policy evaluation exercise using single and combined policy analysis. We use this to assess the implications of alternative policy combinations within a simulation framework.

The third, and perhaps the most important objective of this thesis is to emphasise the importance for the monetary authorities (MAU) of working within an explicit analytical framework and to discuss the implications of macro simulation models for the construction of a MCF. We also wish to outline ways in which monetary policy can be implemented within a more explicit MCF and the extent to which our model can contribute towards the formation of the

MCF. Monetary targeting is the prime focus of attention here and guidelines will be presented as to how intermediate and operating targets (OTs) can be linked^{1/}. As MAUs are confronted with the dual objectives of correcting major imbalances in macro economic variables and at the same time promoting other objectives such as economic growth, it is vital that basic links among the variables are quantitatively evaluated. This can be systematically done within the MCF and it is hoped that the findings of this thesis will contribute towards improving the process of monetary management in Sri Lanka.

Having set out the objectives of the thesis we shall now proceed with a brief review of the relationships between monetary policy and macro economic activity and elaborate on the reasons why we believe that further research is warranted in this area.

1.2 The Relationship Between Monetary Policy and Macro Economic Activity

The first task is to bring into focus money's interactions within the macro economy. Although it is generally accepted that the money stock (MS) plays an important part in an economy in determining such things as the price level, output and the balance of payments (BOP), the interaction between monetary variables and the rest of the economy has not received much attention in an LDC like Sri Lanka. The determination of the MS is the result of a

complex interaction of the behaviour of economic agents rather than a process dominated solely by the MAU. These agents determine the monetary base that the MAU will supply and the commercial banks determine the volume of loans and other assets banks wish to acquire and the quantity of excess reserves they will hold. The public determines how to allocate their holdings of monetary wealth among currency, bank deposits and other financial assets. The MS that emerges therefore, reflects all these decisions and it is these decisions which need to be further researched if the MS is to be used in policy formulation.

Secondly, there are only a few policy oriented empirical models such as Aghevli and Rodriguez (1979), Reichel (1979) and SEACEN (1981) which combine both theoretical concepts and quantitative analysis which can be used for academic research as well as for policy formulation in LDCs in general. We shall explain in chapter 3 how monetary policy formulation in Sri Lanka has been dictated largely by circumstances or ad hoc decisions primarily due to the absence of an MCF which sets out the interactions more clearly, and empirical research on the effectiveness of policy instruments. We hope therefore, that our research will serve a long felt need in the area of monetary management in Sri Lanka.

Thirdly, we wish to bring into focus the impact of financial innovation (FI) on monetary policy, a subject which has been neglected by many researchers, perhaps

because of an excessive preoccupation with the definitions of what the "ideal" money supply should be. FI is measured in terms of new institutions, new instruments and increased sophistication of services. These developments appear to be important in the MTM in many LDCs due to their fast developing financial structures. This is especially so in Sri Lanka as the impact of FI has not only enhanced the financial intermediation in the system but has influenced the substitution effect (SE) among financial assets. The text book version of the SE emphasised in theoretical expositions does not match Sri Lankan experience for several reasons which we shall elaborate on below. The absence of a market related interest rate policy, the limited number of financial institutions and instruments and the underdeveloped nature of the capital market appear to be some of the major factors. In particular, the type of SE LDCs experience has been strengthened to a large extent by the FI which in fact has resulted in the diversification of the financial structure and financial instruments. More importantly, the FI has made monetary policy more flexible thus accommodating innovations, promoting inventions and facilitating the smooth functioning of the MTM. In this regard, perhaps a more important factor would be the ability of the MAU to influence behaviour of financial intermediaries in a predictable manner via changes in monetary policy. On the other hand, FI also complicates the conduct of monetary policy as a considerable part of the MS has been outside

the direct control of the traditionally defined money supply.

We shall now explain why a departure from the long held narrow view of monetary policy as influencing only the aggregate spending via the regulation of interest rates and credit availability is necessary in the analysis of the dynamic role of monetary policy. In doing so it is necessary to address the neglected issue of the impact of FI and examine its widespread implications for the MTM and the conduct of monetary policy. In particular we wish to emphasise the underlying forces behind FI and discuss the ability of the MAU to control a more comprehensively defined MS within an MCF. This was eloquently summed up by Shackle (1971,p.33); "If the controlling of money is to provide a means of controlling the economy, money has to be something which passes two tests; it must itself have or it must transmit powerful effects on the economy; and it must itself be susceptible to control in appropriate respects".

We shall begin by outlining below the four main approaches to defining money: the conventional approach (CA); the monetary approach (MA); the Gurley and Shaw approach (GSA) and the Central Bank approach (CBA).

The CA views money in terms of its characteristics as a medium of exchange, and the demand for money is essentially seen as a theory of the demand for an asset that is generally acceptable as a means of exchange. The MA defines

money as a "temporary abode of purchasing power". The GSA extends the definition of money from currency and demand deposits to just two of many in the family of claims against financial intermediaries. Finally, the CBA views money in its widest context and the main focus of this approach is not monetary theory per se but rather monetary policy and is synonymous with credit availability or total liquidity. See, for example, Arestis and Hadjimatheou (1982). We regard CBA as a more practical view in the conduct of monetary policy in so far as it focuses on some of the issues which are necessary when viewing money in its broad context.

It is also our intention in this research to highlight some of the key links that are vital in the construction of monetary transmission models which have not received much attention in previous research. The demand for money is a key link in understanding the inter-relationship between monetary policy and economic activity. The relationship between the nominal stock of money on the one hand, and prices, output and the BOP on the other, is crucially determined by the public's demand for money. The standard demand for money function includes income as the scale variable, one or more interest rates or the rate of inflation to represent the opportunity cost of holding money, and the function is generally expressed in real terms. Even if money demand estimates are stable and unbiased, it may not be that easy to relate them to the money

supply function because of the difficulties involved in predicting, in most LDCs, the demand for currency and the holding of excess reserves by banks. Similarly, the dominance of government borrowings and fluctuations in the BOP can result in erratic movements in the assets side of the Central Bank or in the source base (SB). In our study we will try to capture some of these inter-relationships in the demand for money functions through suitable proxies.

A second key link is the selection of an appropriate aggregate price index which relates money to the macro economy. Usually, the chosen price index would be the one which reflects most closely the goods and services actually exchanged for money (all monetised transactions). Therefore, the price deflator used for the scale variable in the relevant money demand function should be the best proxy available for actual transactions and also be the best proxy for the theoretically desired price measure in the empirical model. This may well be in practice the GDP or the domestic absorption deflator.

A third important link is the establishment of the behaviour of the major components of the money stock which reflects the behaviour of the public, the financial sector, other sectors of the economy and the rest of the world. It is at this juncture that the role of MAU in influencing the behaviour of key aggregates in the economy becomes important. The construction of an MCF helps to identify the behaviour of each of these sectors in the money supply

process and their relationship with the other macro variables operating in that process. The MS is the product of the monetary base (MB) and the money multiplier (mm) and the MB is the liability of the Central Bank. The control of the MS therefore, requires accurate prediction of the mm (through the behaviour of currency, required reserves and excess reserves) and also control over the MB. In this regard a policy analysis is necessary to understand the effectiveness of various policy measures that work via MB and mm.

We intend to establish in our empirical work these key links and thus to explain money's relationship with the macro economy. However, it is not feasible to specify these links fully. In other words : "the behaviour of the money supply reflects complex interactions of the various sectors of the economy which can be fully analysed only as an integrated part of the general economic system" [Khatkhate et al (1974,p.748)]. What is clear from the above is that the long held view of money's traditional role and its relationship with the macro economy have undergone several changes which are not easy to capture through one particular model based on a priori theoretical assumptions. Money's role therefore, has to be brought into focus through empirical research and analysed in a more applied context so that institutional and behavioural peculiarities pertaining to individual countries can be taken into consideration, subject to data availability and the inevitable

constraints imposed by economic modelling in LDCs.

Having discussed some of the objectives of our research and the need to model monetary policy within the context of the macro economy, including allowance for any links within the system, we shall now consider some of the more important aspects of the MTM directly relevant to the topic of this thesis. We highlight these issues because they have not received sufficient attention in the previous studies.

To begin with, we shall investigate how monetary policy could trigger the SE through which monetary impulses are transmitted to the rest of the economy. In recent years, the CBA has renewed interest in monetary policy and its relationship with economic activity. According to this view, monetary policy is seen as the set of policies through which savers and investors are put together. To accelerate development of an economy it is seen as essential that the resources of surplus units be put to more productive uses. This requires the provision of more attractive financial assets for surplus units as a repository of transferable savings and monetary policy is expected to comply with such demands. Then, we shall discuss whether monetary policy in Sri Lanka has been able to create attractive financial assets and to influence the fund movements among them. This depends on the ability of the policy instruments to trigger the SE envisaged as responding to

monetary influence.

During the early stages of development when financial instruments are limited, money is looked upon as the major repository of wealth. As money and capital markets become more organised and sophisticated, a result of the FI, the range of assets will be widened. Hence, the monetary policy has to take the "initiative" i.e. to create financial assets other than money if savings are to be fully mobilised in a diversified form. In this context the most pertinent question is whether interest rates could be used as an effective instrument. The answer depends on the degree of SE triggered by interest rate changes. This requires that the rate of return on financial assets be more competitive compared to the rate of return of less productive forms of savings (eg. commodities or gold).

There has been no quantitative evaluation of the role of interest rates in Sri Lanka, although a high interest rate policy was assigned the key role of restoring short term monetary and price stability. In this study we intend to highlight the role of interest rates and their impact on the MTM of Sri Lanka. According to Chandavaker (1971) there are no operationally meaningful a priori criteria for what constitutes a realistic and appropriate level and structure of interest rates. Therefore, interest rates are best regarded as "multivalued" instruments rather than as "targets". Policy in this respect is necessarily reduced to a matter of judicious empiricism, keeping in

view the objectives that are sought to be incorporated in policy. The appropriateness of an interest rate policy therefore, has to be judged in relation to policy objectives. Monetary policy, therefore, has to be based on the delicate balancing of the multiple role of interest rates.

In this thesis we also highlight the problems of policy co-ordination in the transmission process which have not been dealt with adequately in empirical work on monetary management. Empirical evidence presented by Khatkhate (1988) suggests that in DCs the co-ordination between money, monetary policy and the macro economy is difficult because of the sophisticated and more complex nature of the financial system. DCs are sensitive to both internal and external disturbances. Thus, when required, monetary policy can in principle resort to fine tuning demand management in these countries. On the other hand, the MTM in LDCs is less complex, less sophisticated but is more resilient to disturbances. What is required then is a thorough knowledge of the behaviour of the working of the system and the use of policy instruments in such a way as to achieve the desired objectives. Once again the role of policy instruments in transmitting monetary impulses becomes important in order to understand the degree of resilience of the system. An MCF would be helpful in this regard because it not only outlines the inter-relationships but also facilitates the co-ordination between key aggregates. Monetary targeting and effective monitoring would become

essential in this process.

Following from the above, we shall also try to establish in our thesis the fact that, except for institutional differences, there is no fundamental difference in the money demand and money supply functions between DCs and LDCs. These can be accommodated within the specifications of the model. For example, the MB in LDCs is often heavily influenced by deficit financing by the government, which is often tantamount to the creation of reserve money. This interaction between monetary and fiscal policies feeds into the money price relationship. Similarly, offsetting the undesirable effects of money creation becomes a monetary responsibility and this requires a well coordinated effort within a proper framework. The research findings of Aghevli et al (1979) and Khan (1980) also support the fact that the money demand and the money supply functions for LDCs are not basically different from those of DCs although they are influenced by political, institutional and economic factors unique to each country.

We also wish to bring into focus in this thesis the changing art of monetary management and hence, the use of an array of monetary policy instruments. The appropriate way to select these instruments is to give some acceptable criteria in the selection process. These criteria would need to be tested and established through empirical research. Although single or combined instruments could

bring in the desired results the selection of a proper mix is difficult. In the 1970s interest rates and open market operations (OMO) were generally thought to be irrelevant instruments of monetary policy in Sri Lanka. The current view, based on empirical research suggests that even allowing for extraneous considerations (capital scarcity, structural problems and strange political events) both these can be useful instruments of monetary policy. In addition, the choice of instruments would depend on established operating targets (OTs)^{2/} that are closely linked to intermediate targets (ITs). The formation of the "proper" monetary policy mix is not easy, especially when there is no clear understanding of the behavioural relationships concerning money and the macro economy. Economists have tried to model these relationships through highly aggregated econometric models which place the financial sector in a broader context. These models may treat policy variables as exogenous thus focusing on the endogenous variables' behavioural reactions to various settings of exogenous policy variables. Alternatively, they may include reaction functions in the determination of the major aggregates which endogenise the behaviour of policy variables.

It is also our intention to highlight in this thesis the impact of supply promotional aspects of monetary policy, another area neglected by research in LDCs. This deals with the critical issue of establishing a balance between development finance and stability. Supply promotion

requires a continuous flow of resources to the key growth sectors to maintain current output levels, to encourage potential growth sectors and to enhance the productive capacity of future output levels. The growth impact of given resources will reflect the efficiency with which they are utilised. Money and financial assets in general, and monetary policy in particular, stand at the very centre of this process. In this connection, it is worthwhile to assess the efficacy of selective credit controls (SCCs) in promoting the supply side as against the traditional weapons of monetary policy. As the motivating force behind the profitability of investment, money becomes a key instrument for raising efficiency through competitive adjustment of resources in the entire economy. It is from this point of view that the understanding of the supply promotion role of monetary policy becomes more important. Empirical research on money and monetary policy in LDCs has created an awareness of this relationship but has paid little attention to it within the broader context of a MCF.

Finally, we shall deal with another empirical question raised frequently in connection with the effectiveness of monetary policy in small countries and its capabilities for maintaining the delicate balance in handling conflicting objectives. In Sri Lanka monetary policy was assigned the primary role in demand management after 1977 and support from fiscal policy has been minimal in the stabilisation efforts. During this period, monetary policy

was assigned to achieve stability and growth objectives through traditional as well as discretionary measures, in particular, the SCCs. The effectiveness of SCCs is important in Sri Lanka where supply promotional monetary policy is increasingly seen to be needed in the present state of development. In this sense a proper feedback of the effectiveness of these discretionary measures is essential which allows for periodic review of the existing policy mix. It is in this background we intend to use variables which capture "availability effects" in the equations of our empirical model and simulate effects on the macro economy. This important task would be made easier within an MCF since the key operational parameters would be identified before policy measures are initiated.

Having explained the major objectives of this thesis we complete this introduction with a brief description of the contents of the following chapters. The thesis consists of eight chapters. Chapter 2 sets out the theoretical framework of the MTM. Theoretical expositions by schools of thought such as the "Keynesians", "Monetarists" and the "Portfolio Balance Approach" are discussed in detail. Chapter 3 presents a historical perspective of monetary management in Sri Lanka between 1950 and 1985. This chapter contains details of the use of various monetary policy instruments and brings into focus the difficulties of implementing monetary policy in the absence of sufficient feedback about the relationship between money

and the macro economy. Chapter 4 is divided into two main sections. The first reviews the previous literature and research on the MTM including that directly relevant to Sri Lanka. Of these, the most relevant study, which involves an empirical model, is reviewed in detail as we use a similar type of a model, in our study. The second section presents the specification and estimation of our model. The validation of the model is dealt with in chapter 5 through dynamic simulation including multiplier and sensitivity analyses. Having established the dynamic properties of the model, in chapter 6, we put together the knowledge gathered from previous chapters and attempt to identify the major MTCs of monetary policy in Sri Lanka during the period under review. The results of this chapter then form part of the MCF in chapter 7 where we conduct policy analysis in the first part and discuss implication of our model on the construction of a MCF in the second part. We assess the impact of single policy instruments as well as combined policy instruments under three main policy scenarios. In the second part of this chapter we also analyse the contribution of macro simulation models on the formulation of the proposed MCF and analyse how a MCF can be used for effective monetary policy formulation. Chapter 8 then synthesises the findings of the previous chapters, discusses the limitations of our study, and suggests areas for further research.

FOOT NOTES

1. In the context of macro economic targets, annual growth of money and credit aggregates are conceived of as "intermediate targets". Authorities require some direct instruments which can be effectively used to achieve these targets.
2. Operational targets (OTs) are the monetary and credit instruments used in the context of week-to-week and month-to-month to hit the annual monetary and credit targets. These operational targets are usually under the direct control of the monetary authorities.

CHAPTER 2

THEORETICAL FRAMEWORK FOR THE TRANSMISSION MECHANISM

The objectives of this chapter are two fold. The first is to outline the theoretical views of "Keynesians", "portfolio balance approaches" and "rational expectation theory" in so far as they represent different views of the MTM. The second is to review the working of the MTM in LDCs, in particular, Sri Lanka and to consider the extent to which the expositions above can be useful in explaining MTCs. We do not however, outline the full versions of these theoretical models but present only those sections relevant to the MTM. Also, we do not wish to emphasise the effects of exchange rate movements in transmitting economic disturbances across countries and their impact on the MTMs.

2.1 Keynesian and Post Keynesian Analyses

The analysis of the role of monetary policy in the Keynesian System begins with an evaluation of the quantity theory equation itself. According to the classical model the monetary sector of the economy revolves around the quantity theory equation:

$$\frac{MV}{T} = PT$$

with M, $\frac{V}{T}$, P, T representing the money supply, transaction velocity of circulation, the price level and the level of real transactions respectively. The implication was that if

V_T and T were fixed, a change in the money supply M would lead to an equiproportional change in P . The Keynesian criticism as explained in Keynes (1936) was based on several grounds. First, real world experiences, particularly in the 1930s showed that the full employment was not the natural equilibrium state of an economic system and T was not fixed. Prices (P) are not flexible downwards. Any monetary impulse from the left hand side of the equation V_T will change T primarily and will only affect P should the "special case" of full employment exist. This argument rejects the classical proposition of "neutrality" of money and the proportionality of changes in money and prices.

Secondly, Keynes argued that far from being constant V_T is likely to be highly unstable and volatile as a result of precautionary and speculative demand. In fact, money balances will be absorbed at first into speculative demand so that any increase in M is partly or wholly, nullified by a reduction in V_T . The instability of V_T is heightened by the assumed volatility of the demand for idle balances dependent on expectations of the future rate of interest. Given these two assumptions, any monetary impulse will be weakened by an opposite movement in V_T , and if MV_T is on balance affected, the impact will, in normal circumstances, be on T and not on P .

Thirdly, "Keynesians" argued that the treatment of the money supply as exogenous is too simple. The unidirectional movement from M to PT was disputed. At the other extreme, "Keynesians" argued that under certain circumstances, the money supply is completely demand-determined. See Radcliffe Report (1959). Any increase in PT causes an increase in the demand for money which may be automatically matched by a rise in the money supply. The Keynesian position may still be characterised by the view that for all practical purposes, "money does not matter" as far as influencing output and inflation. This is a particularly valid argument in a fractional reserve system where the government is concerned with interest rate stability and not monetary control. See Dennis (1981). Keynesians reduced, therefore, the power of monetary policy (non-neutral effect on the economy) and cast doubt on the independence of monetary control. Accordingly, the role of money and the MTM was investigated in a new direction.

We shall now deal with the theoretical framework of the Keynesians and the post Keynesians. The main theme of this analysis is that money influences economic activities through three major channels, i.e. the substitution effect (SE), the wealth effect (WE) and the credit rationing effect (CRE). The theoretical framework used in this analysis is the Keynesian Income/Expenditure model which highlights the fact that monetary policy operates through the interest rate channel. The basic assumption of Keynesian

analysis is the close substitutability between money and other financial assets, in particular, government-bonds. A small rise in the rate of interest on such assets, would cause investors to move out of money into those assets. The interest rate referred to in this exposition is the interest rate on government bonds or long term government securities, and this is the representative rate on all types of assets. This simplicity assumes that equities, bonds and private debts are all perfect substitutes for one another. The change in the rate of interest affects investment and possibly consumption and therefore, aggregate demand. This in turn has a multiple effect on equilibrium income.

2.2 The Structure of Keynesian Models

In the Keynesian model i.e. Keynes (1936, chapters 11 and 12), which may be regarded as representative of a broader class of "keynesian models" the goods market is represented by the following equations: an identity which defines planned total demand for domestically produced goods (at factor cost): an equation representing the goods market equilibrium which assumes that an increase in planned demand is met by an increase in the supply of domestic output: an equation for real consumer expenditure which is determined by real personal disposable income together with an autonomous consumption, eg. hire purchase credit: an equation for private gross investment: an equation for exports which depends on the level of world trade and the relative price of exports: and an equation for the

volume of imports determined by the marginal propensity to import and the influence of the relative price of imports.

2.2.1 The Substitution Effect (Interest Rate Channel)

According to Keynes (1936) a change in the volume of money (money supply) given a stable interest responsive demand for money function, alters the rate of interest so as to equate the demand for money with the supply. The elasticity of the demand for money with respect to interest rates on such liquid assets, is therefore, high. The change in the rate of interest then influences investment expenditure which in turn affects equilibrium income directly and indirectly through the multiplier. The relationship between the interest rate and the demand for money and expenditure and the rate of interest are assumed to be crucial. Variables included in the demand for money function in most empirical studies are: an interest rate and an income variable or wealth. For details see Dennis (1981).

In the construction of the demand for money function, the strict Keynesian analysis considers only the substitution between money and bonds, but not between money and real assets or real expenditure. This is justified on three grounds. Firstly, Keynes noted the ambiguity of any definition of money supply i.e. the absence of a clear dividing line between money and "near money" in an advanced

economy and the high degree of substitutability between money and the other financial assets. According to Keynes (1936, p.161) "we can draw the line between money and debts at whatever point is convenient for handling a particular problem". Secondly, it is cheap and convenient to shift between money and financial assets and finally, the existence of a spectrum of assets ranging from money (earning no interest and being perfectly liquid) to long term government debt (earning high interest but relatively illiquid) facilitates movement between assets throughout the range. These three arguments revolve around the inability to distinguish - at least in some of their characteristics - between money and a variety of liquid financial debt instruments. For details see Goodhart and Crockett (1970).

We shall now discuss the role of interest rates in Keynesian analysis. The rate of interest is a measure of the cost of capital and also an indicator of the stance of monetary policy. Therefore, it is the key linkage variable between real and financial sectors. According to the simple IS/LM model, the interest sensitivity of investment is reflected in open market operations which affects the money supply and in turn the interest rate on financial assets. This influences investment spending and then the aggregate income (GDP).

According to this, money is only a substitute for financial assets and the efficacy of monetary policy is

dependent on two factors: the extent of the change in interest rates (on financial assets brought about by the change in money) and the effect of interest rate on investment spending. Therefore, the relative magnitude of the interest elasticity of demand for money has to be compared with the demand for goods and services. According to Goodhart and Crockett (1970,p.161) "the effect of a change in the money supply seems to be like a ripple passing along the range of financial assets, diminishing in amplitude and predictability as it proceeds further away from the initial disturbances".

In the sections below we shall discuss the wider impact of the rate of interest. The impact of interest rates via changes in the quantity of money affect expenditure decisions in the real sector by causing changes in relative asset yields (SE) thereby influencing the amount of assets people wish to hold. In general, these effects can be thought of as the impact of monetary policy on investment decisions of the productive sector and savings decisions of the personal sector. In the case of investors, a drop in yields on financial assets (including money) will widen the gap between yields of real and financial assets. The SE works entirely through the rate of interest on long term government bonds. Thus, Keynesian theory can be interpreted as a theory of portfolio selection between money and bonds. Under the assumption that government bonds, equities and private debt are

perfect substitutes and that the capital market is competitive and well functioning, the equilibrium interest rate represents simultaneously the rate of return to lenders, the cost of funds to borrowers, the rate of return on investment and the opportunity cost of holding money. See Tobin (1961). This situation makes it profitable to those in the production sector to run down holdings of financial assets or issue new financial liabilities on themselves in order to obtain funds to purchase additional real assets. A drop in the yields on financial assets relative to those on real (tangible) assets should therefore, raise the demand for real assets. This is particularly so, when the range of financial assets is limited, ie. given the limited supply of real assets excess demand will ceteris paribus raise the price of real assets. For details see Park (1971).

From now onwards we shall look into the SE between financial and real assets as envisaged in Keynesian and the post Keynesian expositions. If the real assets in question are producer goods and consumer durables, a discrepancy between their returns and those of financial assets will provide an incentive to expand production of those goods. On the other hand, if the real assets under consideration are gold, ornaments, jewellery, land and land improvements and stocks of agricultural commodities (whose supply is fixed or extremely price inelastic in the short run), an increase in the quantity of money will through similar

channels lead to a steep rise in the price of these assets. The high prices of real assets relative to their cost of production (if nominal wage rates do not change in the initial stages) will induce expansion in the output of real assets. Consequently, investment will be raised. Some may try to avoid the price hike of new assets by hiring existing assets; therefore, the rise in prices of new assets will be tempered by the availability of the existing (underutilized/unutilized) assets.

At this point it will be helpful to look at the direct investment effects experienced by LDCs. Changes in the quantity of money would also have more pronounced and quicker effects on private investment expenditure in conditions where the modern industrial sector is relatively small. In many LDCs investment opportunities are often greater and price inflation is more pronounced. It may therefore, be appropriate to conclude that desired investment spending would be more sensitive to changes in the quantity of money and hence, the role of money in influencing economic activity is likely to be more important in developing than developed countries. According to Keynes and the post Keynesians the impact of an expansion in the money supply is reflected through the rate of interest on bonds. Extra money balances will be first spent on financial assets. Additional demand for bonds drives up bond prices and brings down interest rates. The level of additional demand would depend on the size of the drop in

interest rates and the sensitivity of spending to a fall in interest rates. The MTM could, therefore, be very clear and the effect of an expansion in the money supply will be directly felt if all three channels are in operation. However, if there are several unexplainable events happening in this process identification will be difficult.

Let us now look at the impact of the SE on savings decisions as explained in Keynesian theory. A fall in the yield on financial assets will lower the volume of consumption goods in future periods and will influence savings decisions out of current incomes. Consequently, the drop in interest rates would result in a reduction of future income from current savings. On the other hand, those who intend to run down financial assets, would be encouraged to dissave or borrow. Although there is a possibility of some saving more when the interest rate falls, it is not a very common occurrence.

We shall now deal with the three-stage keynesian transmission mechanism which is usually termed the "cost of capital channel" and examine the main transmission channels in the Keynesian framework. For a good review see Dennis (1981).

According to this exposition, the money supply is assumed to increase due to an open market purchase of government debt by the authorities. An increase in the money supply will lead to a reduction in the rate of

interest. Due to low interest rates, investment would rise leading to increases in income. Keynes (1936, pp. 200-201) stated that "monetary equilibrium is restored by this combination of interest rate and income changes with the demand for money rising to equality with the increased money supply". The major conclusions that emerge from this analysis are firstly, that the monetary expansion only affects the level of income and economic activity indirectly. "It is by playing on the speculative motive that monetary management is brought to bear on the economic system". For details see Keynes (1936, p. 196). Secondly, that although feedback effects on money demand due to a rise in income are both complex and difficult to represent diagrammatically they are essential parts of the MTM.

In this section we will highlight the transmission process explained by Keynesians and post Keynesians and the relative importance of money in DCs and LDCs. In particular, the SE implies that a given change in the quantity of money may have a longer term effect on spending and income in LDCs than it would have in DCs with their sophisticated financial structures and well developed money and capital markets. This follows from the fact that in the absence of a variety of financial assets, the only alternative to holding money as a form of wealth would be real assets, which could be the case in many LDCs. When the financial asset structure is simple, the impact of a change in the quantity of money will not be diffused among

various money substitutes, but will be transmitted directly to the markets for real assets, and therefore money's influence on real expenditure would be greater in LDCs than DCs. For similar reasons, it could be argued that the time lag involved in the MTM would be relatively shorter in LDCs because of the limited range of financial assets and the shorter time period involved in the transmission of SE to the other sectors. The broader the range, the larger will be the chain of transactions and hence, the longer the time lag.

In this connection, Keynesians suggested that fiscal policy would have stronger influence on aggregate demand. If as a result of a shift in an exogenous factor, investment falls and hence aggregate demand, fiscal measures would raise aggregate demand.

To approximate the situation in a typical LDC it would be useful to analyse the effects of monetary policy on aggregate demand and the BOP. If the private sector can hold financial assets in the form of deposits with the commercial banks and loans in the informal credit markets (ICMs), they can borrow from either of these two sources. Investing in shares issued by the public/private sector companies also forms a part of holding financial assets. In addition, the private sector holds both reproducible and non-reproducible real assets. On the other hand, lending and deposit rates of commercial banks are generally fixed and very often are below the rates in the ICMs.

We shall now examine the situation in many LDCs from a more pragmatic view of the MTM. Keynesian and the post Keynesian theories indicate that monetary policy is likely to affect growth mainly through its impact on domestic investment. Empirical studies done in developing countries indicate two of the principal constraints on investment. For details see Coats and Khatkhate (1980). They are the availability of financial resources and the high cost of capital. Even when adjusted for risk, the rates of return on capital investment in these countries are typically higher than real interest rates on loanable funds, the former often kept artificially low by governments. In Sri Lanka, this was the case prior to 1977 during when interest rates were administratively controlled and kept at a very low level. In fact, low or negative real interest rates resulted in an excess demand for capital.

To summarise, the Keynesian transmission mechanism of money is complex and indirect. Its strength is derived from the size and stability of a set of elasticities. This is not, however, the complete analysis of the impact of monetary policy on an economy even within a Keynesian framework. According to Dennis (1981, p.87) "debate in recent years has centered on the existence of alternative channels of the MTM which either augment the power of monetary policy if they are accepted as theoretically and empirically valid or do not reduce if they are rejected".

At the same time, the desired spending may not be responsible for decreases in interest rates. As common in many LDCs including Sri Lanka (prior to 1977) interest rates are kept at artificially low levels and therefore, the SE may not have taken place. As suggested by Jorgenson (1963) a more systematic approach to the determination of interest rates should be used where the rate of interest is but one of a number of explanatory variables, i.e. various demand and expectation concepts. Therefore, there may not be a direct link between money and real spending. Hence, the MTM and its relationship with the aggregate demand is less predictable and less powerful.

2.2.2 The Wealth Effect (WE)

We shall now deal with the WE brought into focus by the Post Keynesians and discuss the impact of changes in net private wealth as well as income as a factor influencing real flows of expenditure and through it, the macro economy. According to Laidler (1985) the WE arises when changes in the price level shift the IS curve and influence the level of aggregate demand directly, rather than by way of their effect on interest rates. The basic hypothesis is that consumption depends on the real value of the stock of assets held in the economy as well as on income. The greater the stock of wealth, the higher the consumption ceteris paribus. An economy's wealth stock consists of interest bearing private and public sector debt and non-interest bearing private and public sector debt.

The relationship between net wealth of the private sector and consumption ("Pigou Effect") was later developed by Patinkin (1974).

Keynesians dealt with three types of WEs, i.e. the Pigou Effect, the Real Balance Effect and the Keynes Wind-fall Effect. According to the Pigou Effect, if an economy were in a Keynesian type unemployment state the price level could be forced down due to excess supply of commodities. This would raise the real purchasing power of wealth and if wealth were an argument in the expenditure function it would cause consumption and income to rise. According to the real balance effect, a rise in the money supply would induce WEs which in turn will influence their spending plans and hence real aggregate demand even if there is no change in the rate of interest. As the money stock constitutes a component of the net wealth of the public, an increase in money would influence spending. If monetary policy is powerless in a liquidity trap situation while investment is interest-elastic, a rise in the money supply would be channeled into idle balances.

A third type of WE is termed as the "Keynes' Wind-fall Effect". It operates through a fall in the rate of interest following an increase in the money supply which will raise the value of financial and real assets. This increases the market value of such assets and will cause consumption and investment to rise. The main difference

between Keynes' windfall effect and the real balance effect is that the former will only work when an interest rate change occurs and will fail to operate in a liquidity trap situation.

The WE provides an explanation of a substitution between money on the one hand and real expenditure on the other, which appears to be lacking in the liquidity preference approach of Keynes.

There has been a great deal of empirical work on the real balance effect or more broadly the WE on both consumption expenditure and the demand for money. The proponents of the real balance effect assumed that the money stock (monetary base or outside money)^{2/} is a component of net wealth of the economy, but "inside money"^{3/} is not. Later developments submitted by Gurley and Shaw (1960) extended the WE beyond money to other forms of wealth such as equities and interest bearing government debt.^{4/}

However, it is argued that the full value of the interest bearing government debt is not net wealth, as the interest payments on such debt which must be financed by taxes levied on the private sector, are part of wealth. Accordingly, a fall in the price level will involve a rise in the value of government debt, a consequent rise in the value of the overall wealth in the economy and hence, a rise in the level of consumption expenditure. Therefore, if the public considers future tax liabilities only as a fraction of interest bearing government debt liability,

then an open market purchase of government paper would change the net wealth of the public and hence, aggregate demand. To summarise, apart from the above provision all interest bearing government debt should not be included in the definitions of net wealth and therefore, the operation of the "Pigou Effect" is limited.

Although a fall in the rate of interest reduces the cost to the saver of obtaining a present command over the future stream of earnings, it also raises the market value, or in other words, wealth, measured in terms of those assets. In this sense, the WE may outweigh the income effect of the personal sector. Monetary policy, therefore, affects expenditure decisions by changing relative yields causing variations in wealth variables through changes of the market value of outstanding assets. As pointed out by Laidler (1985) for the WE to operate it is necessary that the stock of real wealth vary with the price level. Although the private sector may exchange bonds among themselves, this makes no difference to the overall position in the economy since the wealth of debtors and creditors moves equally and oppositely when the price level changes. So long as there are no effects of changes in the distribution of wealth, privately issued bonds are irrelevant so far as the WE is concerned.

The amount of assets people hold in their portfolios depends on their total wealth and relative

yields. To the extent that an increase in the stock of money balances is regarded as an increase in the wealth of the public, monetary policy action would influence aggregate demand via its WE of consumption and investment. Therefore, the validity of WE on expenditure is dependent on a variety of factors. If there is no change in net wealth following a fall in the price level or an increase in money supply, any increase in expenditure following these changes depends on distribution effects between creditors and debtors. Therefore, it is difficult to expect substantial impacts on expenditure from such effects.

At the theoretical level, the link between net wealth of consumers and real consumption has been refined in the life cycle hypothesis of Ando and Modigliani (1965). They held the view that consumers allocate consumption over their life time, given initial net worth, a rate of time preference and expectations regarding labour income. Pesek and Saving (1967), argued that an economically relevant measure of wealth is the capitalized value of a stream of net income. Although inside money (demand deposits) and outside money (monetary base) are considered to be very different, according to Pesek and Saving the difference between these two is that fiat money or monetary base is produced by the government while demand deposits are produced by government agents, i.e. commercial banks. For inside money, the net income takes the form of earnings of

banks through the process of money creation or intermediation. The capitalized value of earnings therefore, is an increase in net wealth of the economy. The flow of services of outside money generates a positive stream of income and therefore, the capitalized value of this income is then added to the net wealth of the economy.

In LDCs, if real income is more supply than demand determined due to the transfer of labour from surplus agriculture to the industrial sector there can be a change in the price of factors of production. In these cases monetary policy action is likely to change prices of all real outputs more than the supplies of these assets at least in the short run and hence the difficulty in identifying the WE.

2.2.3 The Credit Rationing Effect (Availability Effect)

We shall now discuss the CRE and examine its effectiveness as an alternative MTC. In imperfect capital markets several interest rates are charged by different financial intermediaries. Therefore, the demand for credit is limited not by the borrower's willingness to borrow at the given rate but by the lender's willingness to lend. In these circumstances, what is applicable is a range of rates i.e. for lending and borrowing. The "availability doctrine" presented in the Radcliffe Report (1959) attempted to expand the traditional view of monetary policy by developing a theory of the lenders' reaction to policy changes.

The traditional monetary theory focussed upon the interest rate as the driving force behind the saving/borrowing decision while the availability doctrine viewed the interest rate as a reflection of underlying changes in credit availability. The important point therefore, is not so much the price of credit but the availability of credit in the system.

In the following sections we examine the workings of the CR channel. Accordingly, firms have a desired or "notional" supply of their products based on relative prices, expectations and several other relevant variables. They need credit to produce goods. Credit expansion eases credit constraints, raises supply and fuels aggregate demand. The "credit multiplier" leads to more bank deposits and in turn more credit and operates along-side the standard Keynesian income multiplier. As explained by Blinder (1987,p.332) "if the required amount of credit is not available and firms fail to produce as much as they can sell, it may lead to a failure of effective supply. Supply failures are crucial because if recessions are initiated by declines in supply, rather than by declines in demand then prices may rise as economic activity contracts".

In the application of this theory to the LDCs it is evident that when the amount of credit is limited and the price mechanism does not operate smoothly as an allocative device, it is generally more realistic to assume that the flow of private investment is constrained mainly by the

availability of credit. As the control of bank credit generally represents one of the main instruments of monetary policy in LDCs, the authorities can influence the rate at which private investors achieve their desired level of investment. In the absence of a market clearing price, interest rates may be slow to adjust to changing market conditions or they may be administered and will reach the equilibrium level only by chance.

CRE will occur irrespective of a change in the money supply. However, a money supply change can alter the size of the CRE by shifting the credit supply curve. For example, an increase in bank reserves leads to increases in credit and money supply and will result in an outward shift of the supply function causing a reduction of CR. In these circumstances, it is assumed to have quick and predictable effects on expenditure but the response will be more widespread if all financial institutions in the system are involved. This may even result in an increase in holdings of financial assets in the short run, a feature seen in many LDCs including Sri Lanka.

CRE are also likely to arise in relation to the interest rate on government bonds. If the authorities decide to effect a once-and-for-all increase in the rate of interest on bonds, then banks which hold such securities are "locked in" to potential losses on them. They do not want to sell and suffer capital losses or wish to wait and

see if prices move up again. This "locking in" effect is postulated to lead to a reduction in the supply of bank loans to take account of the potential losses on highly illiquid bonds. For a detailed explanation see Silber (1969). Bank credit will therefore, be rationed at a given loan rate and this will lead to a reduction in investment and other expenditures financed by such credit.

Even if interest rates adjust instantaneously the amount of credit made available would still decline. If however, the demand for loans was completely inelastic with respect to long term bonds and the rate of interest on them adjusted immediately, the volume of credit advanced would remain fixed. Although this effect is unrelated to the movement of an exogenous money supply, the influence on the flow of credit is related to the MTM. However, by influencing the flow of credit such actions are monetary in nature, and should be considered as an MTC. Moreover, the availability effects can outweigh the effects of interest rates particularly, in demanding interest bearing financial assets.

In this section we will examine the relative effectiveness of CR compared to the other MTCs and assess its impact on LDCs. Among the MTCs, CR is the most direct channel although it is difficult to measure its influence on total credit. This is largely due to the existence of an almost insatiable demand for credit at the prevailing interest rate in the formal credit market (FCM). Moreover,

deposit flows to financial intermediaries may not be very predictable nor can their asset compositions be changed easily in the short run. Under these circumstances, commercial banks in LDCs will be forced to ration borrowers through various non-price means. Alternatively, Central Banks, such as Sri Lanka, often introduce SCCs thereby forcing the commercial banks to ration credit among borrowers which may have a direct impact of reducing private sector consumption and investment. CRE therefore, not only reduces the availability of credit but also raises the cost of borrowing if borrowing occurs in the ICMs at high interest rates.

In practice, commercial banks often classify their customers into a small number of categories. The risk free customers who are rated as prime customers are little affected by CR. In the other categories, some rationing would occur depending primarily on the risk characteristic and credit worthiness of the customer. Small firms whose bank relationships are not so good would seek access to other sources of finance. They may either rely on credit from big firms or ICMs. Eventually, overall credit falls and interest rates would go up. If other things remain unchanged, the increase in market rates would in turn reduce investment expenditure^{5/}. If interest rates are pegged, and capital or other financial markets are not so developed, a limited availability or rationing of loanable funds would be directly transmitted to the real sector in

the form of reduced expenditure by business firms and individuals.

Monetary impulses can therefore, be transmitted to the real sector by reducing the availability of funds from financial intermediaries rather than through a change in interest rates. Empirically, measuring and identifying the CRE is difficult. In most cases details of non-price effects such as changes in downpayments and collateral requirements are not recorded. An approximation to CRE is to find out the degree of CR by calculating the ratio of actual deposit flows of financial intermediaries to the expected flow of deposits. If CR is effected through a set of SCCs it is possible to estimate the reduction in domestic credit and assess the impact on the macro economy.

In summary, the availability doctrine discusses the role of the lender as an intermediary between monetary policy and spending and also the institutional lending structure's importance in analysing monetary policy effects. It also focuses upon the importance of the channels through which monetary policy affects the economy and often complicates the transmission of monetary impulses through the other channels, in particular, the interest rates.

In this section, we explain briefly the direct effects of changes in the money supply associated with its

impact on expectational variables. Firstly, expectations of the future rate of inflation may increase when a money supply increase occurs which may lead to two conflicting results. A liquidity effect may lead certain individuals to reduce expenditure and hold more money balances to maintain living standards when prices increase. Alternatively, others may spend more now to beat the price increases. It is difficult to say which of these will dominate. Secondly, a money supply increase may encourage investment by generating expectations of cheaper and more accessible finance and of demand increases. On the other hand, when money supply targets are set, expectations of more restrictive monetary policies may generate and may lead to more negative expectations on investments. Any net impact of the changes of expectations would therefore, lead to shifts in the IS curve although the direction is ambiguous due to a number of conflicting effects.

2.3 Appraisal and Recent Developments in Keynesian and Post Keynesian Theory.

In the following sections we shall consider the main criticisms of the Keynesian and the post Keynesian theories in the MTM.

In the Keynesian income/expenditure model, real capital goods do not appear as an asset in financial portfolios because they are assumed to be perfect substitutes for long term bonds. In practice money is a substitute not only for bonds, but also for real assets and

therefore, monetary policy operates "directly" in a framework in which real assets are explicitly introduced along with other assets. This argument is more in line with monetarists and is associated largely with Fisher and the other classical economists. According to them an increase in money would lead to a purchase of real commodities. For more details see Silber, et al (1971).

A second drawback of the Keynesian transmission channel is that it takes place through one single route from money to bonds and from bonds to real assets. Therefore, in the absence of any direct effects of money on income, the Keynesian monetary policy link and the transmission mechanism is very weak. Keynesian models tend to assume two major sectors, i.e. the public sector and the private sector, and two forms of assets: i.e. public sector bonds and money. The SE is expected to work entirely via the interest rate on government bonds. If the WE on the demand for real assets and on the propensity to save is relatively small, the effect of monetary policy changes would depend only on the relative size of the demand for money in response to changes in bond rates. One of the major issues in this regard is to explain how the SE take place in situations where there is no substitution between money and government bonds, a feature observed in many LDCs, including Sri Lanka. Moreover, the highly aggregated Keynesian model ignores sectoral responses which are important in LDCs i.e. structural bottlenecks.

Thirdly, the Keynesian speculative motive for holding money does not provide a satisfactory explanation for the non-zero interest elasticity of the demand for money in an economy where short term securities exist. In such economies changes in the current rate of interest and expectations about capital gains or losses are not sufficient to explain the substitution between long term securities and money.

Finally, the assumption of perfect market conditions in the Keynesian Income/Expenditure model, is not a reality in many LDCs. Wealth and relative price effects occur only if these conditions are satisfied. There is no analysis as to how the situation can differ if markets are not perfect, a feature especially relevant to LDCs. It is also assumed that the interest rate is exogenously determined. However, in the long run when personal sector savers and the business sector play a more dynamic role in the determination of interest rates it may not be valid to assume this. There is no explanation in the Keynesian model as to how the SE and WE work if interest rates are not entirely exogenously determined. Changes in wealth itself lead to changes in consumption and desired holdings of assets. However, this aspect has not received due attention in Keynesian analysis.

The restriction of Keynesian theory to money and a representative long term bond alone has attracted consider-

able criticism. Leijohnufvud (1968) categorised long term bonds with real assets and all short term financial assets with money. Tobin's analysis of the relationship between the expected rate of return and risk can be modified to include various real and financial assets with differing maturities between which the individual establishes his optimum portfolio subject to an interest return. Leijohnufvud's (1968) reinterpretation of Keynes' liquidity preference theory suggested that liquidity can be held not only in money form but also in a variety of short term assets such as building society deposits and treasury bills.

In sum, the Keynesian MTM is complex and indirect. Its strength is derived from the size of a set of elasticities and a series of behavioural relations. In the IS/LM framework, the impact of monetary policy in terms of a Keynesian approach depends on the relative magnitudes of the interest elasticity of the demand for money as compared to that of goods.

2.4 Portfolio Balance Approaches

We shall now analyse the portfolio balance approach as an alternative explanation of the MTM. This approach emphasises the portfolio management of various assets and has been used by both non-quantity and quantity theory monetarists. Ideas of neo-Keynesians are represented by non quantity theory monetarists (NQTMs) while those of quantity theory monetarists (QTMS) are represented by the mone-

tarists in particular, Friedman (1970 a), Brunner and Meltzer (1971). The difference between these two groups appears to relate to their differing views on the uniqueness of money and their priorities in terms of research.

2.4.1 The Non-Quantity Theory Monetarists (NQTMs)

First, we deal briefly with the basic ideas of this approach and outline the analyses of the two groups within this framework.

According to the NQTMs^{6/}, money supply is not entirely exogenous and is influenced by the monetary authorities i.e. but is partly endogenous and reflects the economic behaviour of financial intermediaries and economic units. The major thrust of the NQTMs' analysis is based on the difference between real and financial sectors. The financial sector deals with the stock of assets and debts and its framework is the balance sheet. The decision variables are stocks. The real sector deals with income flows, expenditure and the production of goods and services. Its accounting framework is the income statement and the decision variables are flows. According to Tobin (1961) the two sectors are linked by "accounting identities" and technological and financial stock-flow relations.

According to this approach, there is no unique role played by money among all financial assets. The only

difference between money and securities is that the interest rate on the former is exogenously fixed by law or convention while the rate of return on the latter is endogenous and market determined. According to the portfolio approach when the supply of any asset is increased, the structure of the rate of return on this and other assets must change in a way that induces the public to hold the new supply. If interest rates on assets rise, a large part of the necessary adjustments in the money market will take place. If however, rates are fixed, adjustments must take place through reductions in other rates of return or increases in the prices of other assets.

Secondly, monetary policy operates through changes in the market prices of equities which represent claims on existing real assets such as plant and equipment. If monetary policy is expansionary it will raise prices and reduce the yield of equities and will create a discrepancy between the market valuation of real assets and their cost of production. This discrepancy provides an incentive to expand production of those real assets. Thus, the equity rate serves as the major link between money and the level of economic activity. In a more applied sense, if the Central Bank reduces the reserve requirements of commercial banks the latter will demand more government loans, bonds and securities and low risk obligations in their asset holdings while creating more demand deposits. As their demand rises, prices of financial assets will go up and

interest rates on those securities will fall. Therefore, financial assets will be more expensive in relation to non-financial assets such as real property and consumer durables. The effect of this will be felt through increased prices for non-financial assets which will stimulate an increase in the demand for current productive services both for producing new capital goods and for purchasing them.

Thirdly, the portfolio approach advocates that changes in the real sector can also take place independent of any changes in monetary policy. There can be changes in portfolio preferences or asset demand functions by banks. Therefore, it implies that the impact of monetary policy cannot be captured by any single exogenous or intermediate variable such as the money supply or some market interest rate. According to Tobin (1972), they are at best "imperfect and derivative" indicators of monetary policy.

Fourthly, the portfolio balance approach implies a variety of assets and a range of interest rates rather than a single rate of return. Therefore, the main target of monetary policy should be to maintain the required rate of return on capital or equity yields. According to Tobin and Brainard (1963) equity rate therefore, is assumed to be the major link between money and the level of economic activity.

However, despite the complicated theoretical explanation of real and financial sectors adopted by this

school the MTM remains naive and simple. If one draws a parallel to Keynesian analysis the essential link is nothing other than the emphasis on the rate of interest on financial assets. Secondly, the NQTM's have not been supported by empirical evidence in LDCs as equity rates cannot be regarded as the link between money and the level of economic activity. For details see Khatkhate (1988). For example, in Sri Lanka there is no representative equity rate in view of the absence of a well developed capital market.

2.4.2 The Quantity Theory Monetarists (QTMs)

QTMs tend to assume that a change in the money stock is the primary determinant of changes in total spending and should be given major emphasis in economic stabilisation programmes. Movements in the quantity of money are the most reliable measure of the thrust of monetary impulses and are transmitted to the real economy through a relative price process (portfolio adjustment) which operates through a wide array of financial and real assets.

According to Friedman (1970,1971) an economy can be characterised in terms of the following six equations.

Real Sector

$$\frac{C}{p} = f\left(\frac{Y}{p}, r\right) \dots (1)$$

$$\frac{I}{P} = g(r) \quad \dots (2)$$

$$\frac{Y}{P} = \frac{C}{P} + \frac{I}{P} \quad \dots (3)$$

Monetary Sector

$$M^d = p.l \left(\frac{Y}{P}, r \right) \quad \dots (4)$$

$$M^s = h(r) \quad \dots (5)$$

$$M^d = M^s \quad \dots (6)$$

where,

Y = money income

C = consumption

I = investment

r = the rate of interest

P = the price level

M^s = money supply

M^d = demand for money

In this model, equations (1)-(3) describe the real sector while equations (4)-(6) refer to the monetary sector. Equation (1) defines real consumption expenditure. Equation (2) explains real investment and equation (3) is the equilibrium condition in the commodity market. Real money balances in (4) are a function of real income and the real rate of interest (equation 4) while the nominal money supply is assumed to be an increasing function of the r in (5). The equilibrium condition in the money market is by (6).

The model has 6 independent equations and 7 endogenous variables (C, I, P, Y, M^d, M^s, r). Since there are three unknown; Y, P and r one of the variables must be determined exogenously. Friedman, in Gordon (1974, p.35) discussed different ways of solving the system using three different macro economic theories i.e. the income/expenditure theory; the quantity theory, and the monetarist theory of nominal income. The difference between the first two is the condition that is added to make the model determinate.

The Keynesian income/expenditure theory assumes that the general price level is determined outside the system and that there exists price or wage rigidity ($P = P^o$). The system can now be solved for equilibrium Y/P and r .

We shall refer to the other two solutions below but can now highlight the major differences between the classical Keynesian and monetarists analysis. The classical quantity theory assumed that real income is determined outside the system and this allows a dichotomy between the real and the monetary sectors. Therefore, the demand for and the supply of money functions determine the price level. The velocity function in the modern monetarist analysis is more complex, based on certain behavioural variables and is assumed to be more stable. Unlike in the old quantity theory approach monetarists do not assume that either the level of transactions (T) or the price level (P) is fixed, so that any impulse from the left hand side (MV) would change nominal income (PT). According to this

explanation money is non-neutral. However, the money supply is essentially exogenous and dominates any other influence on nominal income. These assumptions combine to yield the monetary theory of nominal income. It does not preclude the influence of non-monetary factors on income but merely highlights the importance of monetary variables. According to Friedman, the quantity theory model is valid for long term equilibrium so that the long term variation in the rate of change of the quantity of money will change only the rate of inflation and not growth in the real sector. Friedman (1968) argued that in the long run monetary policy can control only nominal quantities, i.e. the price level, the money rate of interest and nominal income, but not real variables.

According to monetarists, both NQTM and QTM, the income/expenditure model is not satisfactory for short term analysis because neither explain short term deviations in nominal income between prices and output; short term adjustment of nominal income due to a change in autonomous variables, and the transition between short and long term equilibrium. For details see Friedman (1970 a).

Friedman's approach differs in three major ways from the Keynesian IS/LM framework. Firstly, the LM curve is much steeper in the monetarists' version and this reflects the low substitutability between money and bonds and therefore, the low interest elasticity of the demand

for money. Second, there is no liquidity trap. An increase in the money supply will always alter the rate of interest. Third, the IS curve is less steep and reflects the size of the interest elasticity of investment. As a result, the monetary model of nominal income, assuming that the IS curve shifts far enough to the right as a result of an increase in the money supply, there would be an increase in income and a lower rate of interest. A significant feature of this model is that a change in the rate of growth of the money supply affects the rate of growth of nominal income without any immediate effect on interest rates.

Friedman's demand for money model (1972) sets out the channels by which a change in the money supply affects economic variables on the assumption that money is a unique asset: According to Nobay and Johnson (1977, p.478) "money is to be regarded as an asset in the generalised portfolio, in sharp contrast to the Keynesian tradition of considering money to be a substitute for financial assets". This replaces the Keynesian money/bonds choice by one where portfolio adjustments involve an array of assets, both financial and real. According to Friedman and Meiselman (1963) the crucial issue is not whether changes in the stock of money operates through interest rates, but rather the range of interest rates concerned. This model provides an empirical approach to the estimation of the effects of monetary policy. Friedman indicates that an exogenous change in money stock begins with changes in prices and

yields of financial assets. These changes in the price of financial and non-financial assets influence spending on new assets and current services. They also alter real wealth of the public relative to income and thereby affect consumption. This in a simple fashion is the way in which the initial impulse is diffused from financial markets to the markets for goods and services thus affecting portfolio adjustments.

As in the income/expenditure theory the rate of interest plays a key role, but Friedman in Gordon (1974, p.35) argues that the impact of monetary policy is understated in Keynesian analysis. This is because monetary policy impinges on a range of capital assets and correspondingly a broader range of associated expenditures. The Keynesian practice of looking only at recorded market rates of interest which are only a part of a much broader spectrum of rates makes one underestimate the actual impact of monetary policy. The rates of interest that influence investment decisions are for the most part implicit yields and hence, not observable, so that one cannot hope to obtain useful results by looking at relations between market interest rates and categories of spending associated with these rates. Also, recorded market rates may not be the appropriate measure of the cost of capital since these rates are not real rates of interest that reflect the basic forces of productivity but nominal rates that are influenced by the expected rate of inflation. Monetary influ-

ences may work through any particular channel as monetary policy operates through an extremely complicated process of portfolio adjustments. Even the most complex structure of a general equilibrium model cannot be expected to capture actual monetary influences adequately. One such relationship is the velocity function relating income to money (the essence of the quantity theory). Another is the multiplier relationship between income and autonomous expenditure (essence of income/expenditure theory). In fact Friedman argues that the velocity function has been shown on average, to be more stable and less affected by institutional and historical changes than the multiplier relationship and consequently, the velocity may be the key relationship in understanding macro economic developments. It then follows that a much more promising approach to the question of evaluating monetary policy effects on the economy is to try to relate changes in the quantity of money. Friedman's monetary model of nominal income seems to reflect this point of view.

In spite of the theoretical contribution made by Friedman to monetary theory, empirical evidence does suggest that changes in the quantity of money are associated with changes in interest rates. For details see Galbis (1981). Later monetarists have accepted this and extended the monetarist framework accordingly.

2.5 Later Developments and Rational Expectations Theory

An important contribution made to the monetarist approach, especially in connection with LDCs, was the presentation by Polak (1957). He developed a structure that made imports a function of nominal income and then added a quantity theory of money equation to explain nominal income. In this model, an increase in the rate of credit expansion would increase money supply and nominal income. This in turn would raise imports and cause an outflow of international reserves. This process would continue until the initial increase in domestic credit was exactly matched by the loss of international reserves. This phenomena is particularly important for LDCs like Sri Lanka as the openness of the economy and leakages through imports appear to have aggravated the BOP problems in the period under our study.

According to the Polak model (1957) the effects of monetary policy, CRE in particular, depend on a number of factors, such as the speed with which the limited effects of credit restrictions are offset by international reserve movements (the responsiveness of the current account and the degree of capital mobility), the response of domestic inflation to the excess demand for real money balances created by credit restrictions, the extent to which the excess money demand reduces aggregate demand (the degree of excess demand for output in the economy) and the effect

on private investment of a reduction in the availability of credit. As these factors influence in a complex way the net outcome clearly becomes an empirical question.

In the Polak model, expenditure can be affected directly by changes in real money balances and interest rates or via capital mobility, allowing purchases or sales of assets in response to changes in relative interest rates. The monetary approach to the balance of payments (MABP) developed by Mundell (1968) and Johnson (1972) and Frankel and Johnson (1976) build upon this idea. The essence of the MABP is that BOP will depend on the price level of a country relative to those of its trading partners, which in turn is influenced by the degree of money growth at home and abroad. Therefore, a money supply growth rate that exceeds the world average rate of monetary expansion would lead to a higher price level in the home country relative to that abroad thus generating a deficit in the BOP. The excess demand for money balances plays a direct role in the short run behaviour of prices. Sri Lanka is no exception to this situation and the adverse consequences of excess money balances and their impact on the macro economy is illustrated in chapter 3. As reviewed by Khan (1980) domestic credit will in the short run increase domestic inflation and worsen the BOP. Eventually, the decline in the money supply due to outflow of international reserves will cause a reversal of the process so that once again in the long run the monetary relationship will con-

tinue to hold.

A further development of monetarist thinking relates to the Rational Expectations Hypothesis (REH) which assumes that individual economic agents act as utility maximising individuals. When forming expectations about the future they take into account all available information including the level of GNP, level of their disposable income, monetary and fiscal policies in the current period. In this sense economic agents will form subjective expectations concerning future economic variables which are equal to the true mathematical conditional expectations to be taken by those variables. For details see Muth (1961). In other words, the "objective" probability distribution of outcome associated with a particular policy action will be used to generate expectations concerning the variable of relevance to the economic agent. Assuming this information is used efficiently, the agent's predictions or expectations will be identical to the mean value of the distribution of possible outcomes generated by the relevant theory. In the case of an agent concerned with the future price level this implies that the expected price is in fact an indicator of the actual price.

Lucas (1981) suggested that the adoption of the REH would further improve Friedman's contribution specially when there is no systematic relationship between expectation errors and information available to agents at the time of formation of expectations. The hypothesis could be used

to avoid the implication of sub-optimal behaviour by individuals. Lucas's new theory of price stickiness was used to explain incomplete price responses in terms of choices made by optimizing agents in the light of their own objectives and constraints. However, it is necessary according to this view to understand the nature of price sluggishness to know if its quantitative manifestation will remain intact in the face of altered conditions.

According to Lucas, individuals not only have a coincidence of expected mean and actual mean values but it is also possible for a coincidence between the agent's subjective probability distributions over all possible outcomes and the actual objective distribution controlling the economic system. In such a situation the REH would be tantamount to perfect foresight. Clearly the usefulness of the REH depends on the extent to which individuals' formation of "rational" expectations, and its application is greater the simpler the underlying process to be understood and the less demanding is the information set involved in any given situation.

2.6 Conclusion

The purpose of this chapter has been to outline the main theoretical expositions of the Keynesians and Post keynesian, analyses, non-quantity theory monetarists, quantity theory monetarists including the REH. We have

attempted to expose divergent views about the MTM and to examine the relevance of these ideas to developing countries in general, and Sri Lanka in particular. Despite differing views about the MTM, at present there are probably few major disagreements between economists about it. Both NQTM and QTM support some version of portfolio adjustment as the basic framework describing the MTM. The disagreements however, remain in terms of the range of assets, the range of interest rates and the technical relationships involved in the stocks of real assets and flows of real expenditure corresponding to these assets. For non monetarists the range of assets is limited while for monetarists it is a broad spectrum. According to the Keynesians and the post Keynesians there is only one interest rate (long term bond rate) and this is the representative rate for all types of earning assets. This implicitly assumes that equities, government bonds, and private debt all are substitutes for one another. In the Keynesian analysis the SE is only between money and bonds and it ignores entirely the substitutability between money and real assets or real expenditures (the real cash balance effect). All groups in general agree that WE and CRE are important.

Secondly, although the emphasis on money is different in Keynesian and Monetarist analysis it is probably more of an empirical question than a theoretical one. Keynesian theory sees changes in the money supply working their way

through the system in a way that does not result in a close and stable linkage between changes in the money supply and national income. The monetarists on the other hand, perceive such a close and stable linkage. For monetarists, money is extremely important in influencing the level of money income while according to Keynesian view, money is less important in this respect. Again this is essentially an empirical question.

Thirdly, we noted diverse views on the role of interest rates. Some monetarists believe that the demand for money is crucial in understanding macro economic relationships but place less emphasis on the sensitivity of the demand for money function to interest rates. If however, interest rates are relevant at all to the demand for money, then there has to be a theory of the determination of interest rates. The traditional quantity theory is irrelevant in this sense to the MTM.

Fourthly, views on how to model the MTM differ among the major theoretical groups. Monetarists argue that the MTCs are diverse and, complicated and therefore difficult to identify and measure using large scale structural models. Therefore, they advocate the use of reduced form equation models or direct estimation methods using final demand variables such as money GNP which are regressed upon monetary and fiscal variables. However, the use of reduced form equations raises problems as they ignore prior restrictions on the coefficients of independent variables.

i.e. restrictions built into general equilibrium models through identities, lags etc. They become therefore no more than linear equations relating endogenous variables such as money GNP to a set of exogenous variables with no meaningful economic analysis between those variables.

To monetarists, the major factor determining aggregate demand is money. If monetary policy is expansionary the aggregate demand curve shifts to the right reflecting the increasing demand for goods and services. The MTM therefore, is direct and certain. Extra money leads to direct SE between money and real goods and services but does not spill over into the bond market and raise prices and drive down interest rates. Those who have money would spend it and its impact on GNP would be direct. The main objective of the monetary authorities is to keep money supply at a desirable level. When aggregate demand starts to respond to the increased money supply the transaction demand for money would rise and therefore, the rate of interest would go up. The income effect of the increased money supply will therefore, overwhelm the liquidity effect and as a result, the rate of interest would fall back to its original level. A problem common to both monetarists and non-monetarists is the selection of exogenous monetary and fiscal variables. Depending on the variables that are assumed to be exogenous i.e. the monetary base, reserves, narrow money, broad money (monetary sector) and autonomous expenditure on the fiscal side, one can take either a money

"mostly matters" or fiscal policy "mostly matters" or "both matter" stance.

Our next task is to examine the historical role of monetary management in Sri Lanka before we combine it with the theoretical literature reviewed here in order to construct an empirical model of the MTM for that country.

FOOT NOTES

1. The term 'Keynesian' referred to in this chapter relates to the interpretation of the General Theory of Employment, Interest and Money given by Hicks and others who might be described as 'Keynesians,' within the IS/LM framework, rather than the reinterpretation of The General Theory given by Leijonhufvud (1968) and Clower (1969).
2. 'Outside money' is defined as the money that is backed by foreign or government securities or gold or fiat money issued by the government.
3. 'Inside money' takes the form of various types of deposits which are claims of the public on the banking system. Therefore, when the balance sheets of all economic events are consolidated, 'Inside money' disappears and therefore, should not be considered as a part of wealth.
4. The government ignores the real value of its debt because it can pay back by issuing new debts as it controls the money supply and possesses taxing power.
5. Both the simple quantity theory and Income/Expenditure approach assume that price units are stable. Hence, real and nominal rates of interest are the same.
6. Tobin (1965) and Tobin and Buiter (1976) represented NQTM views.

CHAPTER 3

MONETARY MANAGEMENT IN SRI LANKA 1950-1985

The main objectives of this chapter are three fold. The first is to summarize the instruments that can be used by the authorities to influence the monetary transmission process. The second is to provide a description of the monetary policy stance pursued in Sri Lanka between 1950-1985^{1/} and to critically evaluate the implementation of monetary policy in terms of achieving its objectives. In doing so, we also establish the international and domestic economic environment within which monetary policy in Sri Lanka was pursued, policy thinking with regard to the MTM, and the actual use of policy instruments by the monetary authorities. Thirdly, we wish to analyse the implications of uncoordinated policy and highlight the importance of working within an explicit MCF for effective monetary management. A chronological account of monetary policy measures between 1977 and 1985 is presented in appendix 3.2.

Since independence in 1948 Sri Lanka's economy has undergone significant changes. Being largely an export-import economy, external shocks and volatile commodity prices have been important factors in monetary and fiscal policy formulation. Moreover, novel ideas introduced into monetary management and consequently, the changing art of central banking have also influenced the choice of monetary

policy instruments during this period. To analyse the changes which have occurred over the period 1950-1985 more meaningfully, section 3.2 is divided into three periods. The first relates to the decade 1950-1959 which has been characterized as the pioneering years of monetary management during which monetary policy was "accommodative" and "liberal". The events between 1960 and 1976 are described as the years of control and adaptation. During this period monetary policy was more "rigid" but adjusted itself to suit the economic environment. The third period has been one of moving towards mature monetary management, commencing in 1977 and continuing to the present. Monetary policy was "aggressive" during this period.

3.1 Available Instruments

The Central Bank of Ceylon^{2/} was established in 1950 as the authority responsible for the administration and regulation of the monetary and banking system of Sri Lanka. According to The Monetary Law Act (1949) the Bank is entrusted with the duty, inter alia of regulating the supply, availability, cost and international exchange of money so as to secure the following objectives: the stabilization of domestic monetary values; the preservation of the par value of the Sri Lanka rupee and the free use of the rupee for current international transactions; the promotion and maintenance of a high level of production.

When the Central Bank commenced operations, it inherited a monetary and a banking structure which was oriented primarily to serve international trade and payments. Under the Currency Board System the Rupee standard relieved the country of the burden of managing the exchange value of her currency unit. See Gunasekera (1962). Branches of foreign banks dominated the banking scene and money and capital markets were at rudimentary stages. The primary objective of the post-independence monetary policy was the setting up of an independent monetary system with the required degree of financial autonomy to cope with the problems of monetary management in an emerging nation. Accordingly, the Monetary Law Act (MLA) of 1949 which outlined the law relating to the establishment of the Central Bank of Ceylon gave it a wide array of powers to conduct monetary policy. The Monetary Board which was constituted in July 1950 was directly empowered with responsibility for monetary policy. As regards the issue of currency, the Central Bank differed fundamentally from the Currency Board in that it was empowered to hold domestic securities as part of the assets "backing" the note issue. In the sphere of credit control, the Bank was equipped with all the weapons of modern central banking and instruments of monetary control. The Bank was empowered to deal in gold and foreign exchange operations and grant loans to foreign institutions and was authorized to regulate rates applicable to the purchase and sale of foreign exchange by commer-

cial banks.

Instruments such as discounting and rediscounting of commercial and productive paper used in domestic transactions outlined in sections 83 (a), (b), and (c) in the MLA suggest that interest rates and discount rates were to form the main instruments available for credit operations. Section 89 of the MLA authorizes the Bank to provide provisional advances to the government to finance expenditure while sections 90, 91 and 92 specified the use of OMO. Sections 92-98 dealt with the instruments of Central Bank securities (CBS) and statutory reserve requirements (SRR) in regulating reserves of commercial banks.

Monetary policy instruments are directed at controlling both the volume and the direction of credit. Control over the volume is known as quantitative control of credit and is achieved largely through instruments such as OMO, SRR and the Bank rate (BR). Among the "Additional regulation of credit operations" of banking institutions, the main instruments are the fixing of maximum permissible maturities of loans and investments or classes of loans and investments of commercial banks, the ceilings on commercial bank credit, the fixing of minimum ratios for the stipulation of cash margins against letters of credit and the control over bank interest rates.

3.2 Historical Perspectives

3.2.1 The Pioneering Years: (1950-1959).

During the 1950s, monetary policy in general, was liberal and complementary to the macro economic policy environment in which reasonable growth rates with a fair degree of price stability were displayed. Except in boom years, monetary expansion, measured in terms of currency and demand deposits (M1) had been comparatively modest. In the first few years after 1950, the economy was highly liquid due to the commodity boom during the Korean War. The increased external assets and monetization of export proceeds enhanced liquidity in the system thereby exerting inflationary pressures. Notwithstanding this enhanced liquidity, prices, measured in terms of the Colombo Consumer Price Index (CCPI) dropped from 5.4 per cent in 1950 to 4.0 per cent at the end of 1953,^{3/} probably due to heavy imports.

The Central Bank was mindful of these developments but the need to ensure sufficient availability of liquidity constrained its ability to tighten monetary policy. However, the Bank saw the need for initiating action to reduce imports and to provide BOP support. Hence, the SRRs were used to raise the cost of funds to banks and in turn to discourage credit creation. Accordingly, a SRR of 10 per cent and 5 per cent respectively were fixed on demand and time and savings deposits of commercial banks. The reserve

ratio on demand deposits was raised from 10 to 14 per cent in 1951 to further strengthen the effectiveness of this instrument. To absorb excess liquidity, the Bank engaged in OMO and the BR was increased from 2.5 to 3.0 per cent per annum. This helped to reduce the dependence of commercial banks on Central Bank funds. To release part of the reserves absorbed through high SRRs and to counteract the fall in liquidity caused by the decline in foreign assets, the SRR on demand deposits was reduced from 14 to 10 per cent. This relieved the tight liquidity position of banks and enhanced the flow of bank credit to the private sector. As an indicator of the essentially subservient and accommodative role of monetary policy as compared to fiscal, the interest rate of government securities were lowered to reduce the cost of borrowing for the government. The monetary authorities responded by bringing down the BR from 3 to 2.5 per cent in 1954.

As far as the first half of the 1950-1959 period is concerned, the 5 years ending in 1954, immediately preceding the Korean war boom period, illustrated numerous problems typically encountered by an export economy and policies pursued by the monetary authorities to contain inflation and stabilize the economy. During 1950-1951, although commodity export prices rose to very high levels, no attempt was made to achieve a viable and sustainable BOP position. The economy was relatively free of controls. The ad hoc monetary policy measures introduced in 1950 and 1951

provided only a weak support to the BOP. In the two years ended 1953, both the current account and the basic balance recorded deficits with a sharp depletion of reserves. The gross external assets which were sufficient to support about 13 months of imports in 1949 were adequate to support only 5 months of imports in 1952 and 1953. (Annual Report 1954, Central Bank of Sri Lanka). This situation implies that monetary policy measures adopted during the two years ended 1951 were not forceful enough to nullify the basic disequilibrium experienced by the economy, the key factors being declining export incomes following the collapse of the boom, the rising volume of imports and a credit expansion.

Several factors hindered the achievement of policy objectives during this period. First, the experience of the early 1950s showed that the progress towards achieving a favourable BOP, price stability and desirable money growth required a coordinated effort in fiscal, monetary and exchange rate policies. Moreover, the non-effectiveness of interest rates as policy instruments was clearly reflected during the three years ended 1953 in the inadequacy of domestic savings and investment. Despite the favourable terms of trade and rising exports, the government was unable to generate any savings. While excessive consumption by the government and the private sector resulted in increases in imports, no attempts were made through interest rate policy to offer positive rates on financial depos-

its and to channel funds to investment. Instead, a low interest rate policy was maintained to accommodate government financial requirements at low cost. On the other hand, sufficient action was not initiated to absorb the enhanced liquidity through taxation and reduce the dependence on bank borrowings. Moreover, government expenses were directed towards current expenditure, in particular, welfare and subsidy programmes but not for investment purposes. In sum, the absence of a coordinated macro economic policy package was clearly felt during the period 1950-1953. The adjustment programmes should have aimed at leading the economy into a more stable and sustainable growth path from an unsustainable path that accompanied supply demand imbalances. It is also noteworthy that the Central Bank gave little or no consideration to the promotion and development of the financial structure during this period. This may have been due to an emerging nation's inexperienced central banking.

Secondly, it is evident that in the first few years after the establishment of the Central Bank, monetary policy was not called upon to play a dynamic role within the context of overall economic objectives. The behaviour of macro economic indicators during 1950-1959 are shown in Table 3.1. Although monetary expansion was moderate this was largely due to a draw down in external assets from 8.5 per cent during 1950/1951 to 2.3 per cent in 1955/1956. This situation further weakened the BOP position and there-

fore, did not help to retain favourable benefits

Table 3.1
Major Macro-Economic Indicators 1950-1960

	1950/1951	1955/1956	1959/1960
Rate of Growth of GDP 1/	NA*	NA	4.9
Rate of Growth of GNP 1/	NA	NA	4.8
Rate of Growth of per capita GNP 1/	NA	NA	2.0
Colombo Consumers' Price Index (% change Dec - Dec)	4.0	0.1	-1.6
% change in M1	10.5	5.0	2.7
% change in M2	12.1	7.3	6.4
% change in External Banking Assets (Net)	8.5	2.3	-42.3
Government Expenditure 2/	NA	NA	24.5
Government Revenue 2/	NA	NA	22.8
Balance of Payments 3/	<u>1950</u>	<u>1955</u>	<u>1960</u>
Trade Balance	+328	+516	+332
Current Account Balance	+146	+323	+75

* refers to data not available

1/ = current factor prices

2/ = as a per cent of GDP

3/ = figures for the year are expressed in Rs.Million

Source: Annual Reports, Central Bank of Sri Lanka

associated with the commodity booms. By the end of 1960s the surpluses in both the trade and the current account balances were more moderate. Inflation slowed down largely due to the reduced money growth and the drop in commodity prices, particularly those of tea and rubber by the end of 1953. As seen in table 3.1, the CCPI which stood at 4 per cent during 1950/1951 gradually dropped to less than 1 per cent and to negative levels towards the end of this period. The expansionary fiscal policy was largely reflected in money growth and did not contribute to increased investment

and production.

Thirdly, the continued dependence of the government on the banking system to finance budget deficits raised the money in the system and also undermined the effectiveness of monetary policy measures in force. This, coupled with the low interest rate policy prevented the Central Bank from launching an aggressive monetary policy which would have prevented the authorities from resorting to administrative and rigid controls after 1960. Due to inadequate attempts made to reap benefits from the enhanced external assets, the second half of the 1950s featured a depletion of reserves. Although the need for sustained price and monetary stability was recognized from time to time, this did not persuade authorities to follow restrictive monetary policy measures. Also, the inability of the under-developed money market to adjust quickly and to mobilize resources resulted in an inefficient allocation of investment.

Fourthly, traditional central banking did not involve the promotion and development of the financial structure. Aside from the establishment of the Development Finance Corporation of Ceylon (DFCC) in 1956 in which the Central Bank took initiatives, no other non-banking institutions were set up during this period. In the latter half of the 1950s monetary management was uneventful but the basic problems remained unresolved though at moderate levels. In February 1956 for the first time the Central

Bank issued its own securities worth Rs.10 million which absorbed part of the excess liquidity generated by the government. There was no other occasion for active central bank intervention through OMO. In the wake of declining international reserves, the major source of reserve money was the heavy borrowings of the government from the Central Bank during 1956-1959. On the other hand, the money multiplier varied between 1.61 and 1.93 and appeared to be more influential than the credit multiplier which fluctuated between 0.82-1.43 during the same period.

Overall, therefore, monetary policy during this period was essentially conservative and 'traditional'. It was considered that short term fluctuations were better controlled through automatic adjustments or by fiscal policy instruments such as export taxes. Changes in external assets continued to be the most important determinant of the money supply. Bank lending within the country was geared to foreign trade and the volume of bank credit to the private sector was largely demand determined. The modern weapons of central banking played hardly any significant role in the events of this period. On the other hand, the Central Bank's conventional powers for influencing monetary developments were not used at all according to Gunasekera (1962). To a large extent therefore, fiscal policy was responsible for economic stabilization during this period and was complemented by monetary policy.

3.2.2 The Years of Control and Adaptation: 1960-1976.

The period after 1960 was characterized by intensified control over the major macro economic variables. Monetary policy was adjusted in line with the administratively controlled economy. Changing economic events in the 1960s were more complex than in the 1950s and the major policy considerations that guided general economic thinking during this period were three-fold. First, foreign exchange reserves were no longer adequate to sustain a sizable flow of imports and corrective action was needed to reduce the level of imports and provide BOP support. Second, the rising debt service problem had to be arrested through a reduction in foreign borrowing on the one hand, and a rise in exports on the other. Third, inflationary pressures caused by enhanced monetary expansion in the previous decade had to be contained to restore price stability. Confronted with these three upper most policy considerations, the authorities saw an administratively controlled policy framework as a desirable course of action.

During the late 50s domestic demand, and in particular, the spending of the government and the private sector, continued to expand beyond the country's long term growth potential and the economy lived beyond its means at the expense of a widening trade deficit. These economic events during the early 1960s caused monetary management to deviate from the more general controls to the use of admin-

istrative and selective credit controls (SCCs). The changing art of central banking during the 1960s followed by many Asian countries considered SCCs as one of the effective methods of handling situations in which market mechanisms fail to work. For a detailed review see Bank Negara Malaysia (1984). As the 1960s progressed the Central Bank began to shift its focus to the performance of aggregates such as the volume of bank credit. Direct controls, in particular, credit rationing (CR) was considered an important transmission channel.

In the first half of the 1960s several monetary policy measures were introduced to provide BOP support. These included upward revisions in the BR, SRRs and the introduction of special reserves on incremental deposits. Other measures introduced included margins of letters of credit, rationing of import credit, control over credit operations finance and hire purchase companies, restrictions on credit to resident and non-resident companies registered in Sri Lanka. In broader terms, these measures were intended to help contain aggregate demand and dampen the flow of imports. In terms of action the first priority was to provide BOP support. In view of the steady deterioration of the country's terms of trade, by mid 1960, the import programme was brought within an Annual Foreign Exchange Budget. (Annual Report 1965, Central Bank of Sri Lanka). In addition, exchange controls were introduced on foreign travel and capital transfers. Restrictions were

also placed on the purchase of estates by both local and foreign companies. To complement these foreign exchange controls, on the fiscal front, import duties were raised on a number of occasions during the second half of 1960. While tying up fiscal and exchange control measures with more general type monetary policy measures, SCCs were seen as useful to support domestic production and exports. Maximum interest rates and interest chargeable by banks on advances in respect of production and exports were fixed at rates which prevailed in August 1960 subject to the condition that these rates should in no circumstances exceed 6 per cent per annum.

The second concern was the absorption of excess liquidity. SRRs were raised to tackle the liquidity problem and were further supported by the introduction of marginal reserve requirements (MRRs) in the form of special reserves equal to 38 per cent on any increase in demand deposits over the level of such liabilities as at February, 1961. The impact of MRRs was, however, cushioned by the till cash concession allowed to commercial banks, in that 50 per cent of the required reserves could be held in the form of currency notes and coins. The till cash concession was further raised to 75 per cent during the same year. To discourage commercial banks from resorting to Central Bank funds, the BR was raised from 2.5 to 4 per cent per annum.

Thirdly, monetary policy was also designed to strengthen and further develop existing financial institu-

tions and establish new credit facilities. To provide further support to priority areas, the Central Bank established the Medium and Long Term Credit Fund (MLCF) in May, 1964. With effect from August 1964 advances granted under the MLCF by commercial banks and credit institutions for the promotion and development of industries or agriculture was fixed at 3 per cent per annum. The refinance rate for the purchase of machinery and new tea factories was fixed at 5 per cent with a similar margin to credit institutions. The intensification of import control measures along with tight monetary and credit policy resulted in an enhanced demand for funds primarily for speculative purposes. Against this background, in May 1965, the BR was increased from 4 to 5 per cent per annum thus limiting the general accommodation to commercial banks. The CR was further strengthened thereby minimizing the availability of credit to non-essential purposes. On the other hand, to provide concessions to production and priority areas the Bank refinanced the commercial banks at 3 per cent per annum on credit to co-operatives for purposes of purchasing and storing agricultural products. The Peoples Bank, one of the state banks, which was exempted from MRRs, was required to maintain a special reserve of 28 per cent on incremental deposits.

There are a number of reasons for the change in attitude of the authorities in terms of monetary policy stance. Firstly, by mid 1965, the authorities felt that a

greater co-ordination and structural adjustment support from an outside agency was necessary to cope with emerging problems in the economy. Hence, the SCCs were withdrawn and lending restrictions on overdraft facilities to foreign firms other than those in export trade were reduced. Secondly, the relaxation of these policy measures had been a part of an overall stabilization programme in support of which the International Monetary Fund (IMF) provided facilities under the Stand by Agreement. Moreover, price increases during the first half of 1960s were less than 1 per cent and this did not require restrictive monetary policy measures. Third, to cope with these developments and the excess liquidity situation more general type monetary policy measures were resorted to thereby avoiding the use of SCCs and CR.

Table 3.2 shows the performance of the major macro economic indicators over the period 1965 to 1976. During the latter half of the 1960s price increases measured in terms of the CCPI rose to a peak of 5.9 per cent. The unprecedented increase in prices after 1970 reflected the impact of the first oil shock in 1973. Towards the end of this period monetary expansion stood above 30 per cent although the CCPI dropped to 1.2 per cent during 1975/1976 period. The heavy reliance of the budget on the banking system and the unabated liquidity expansion therefore cast doubts on the efficacy of some of the monetary policy measures during this period. The current account balance

reduced from its negative level (Rs.393 million) to Rs. 50 million during 1975/1976, indicating an improvement in the BOP. During the latter part of this period both investment and domestic savings (as a ratio of GDP) dropped.

As far as the effectiveness of monetary policy followed during this period is concerned, we observe several major features. First, the type of monetary policy measures used during this period suggests that the CR was considered the main channel of the transmission process. Second, no consideration was given to control the reserve money or money/credit multipliers through direct monetary policy instruments such as OMO. The SRRs were used as a means of raising the cost of funds to commercial banks. However, this measure was ineffective in affecting the money/credit multipliers mainly due to the till cash concession granted to banks. The credit multiplier (cm) fluctuated in a range of 1.11 to 1.94 while the money multiplier (mm) ranged between 1.29 and 1.54. During this period the money /credit multipliers appear to have been more influential than the reserve money. Third, apart from the establishment of the Peoples' Bank and the nationalization of the Bank of Ceylon, financial innovation in terms of institutional developments, new instruments and banking facilities showed no progress.

Table 3.2

Major Macro-Economic Indicators 1965-1976

	1965/1966	1969/1970	1975/1976
Rate of Growth of GDP 1/	3.2	8.3	9.1
Rate of Growth of GNP 1/	2.6	8.1	8.9
Rate of Growth of per capita GNP 2/	0.4	5.8	7.2
Colombo Consumers' Price Index (% change December -December	2.2	5.9	1.2
% change in M1	-3.3	4.5	34.9
% change in M2	-1.7	9.2	32.9
% change in Domestic Credit	0.4	9.8	23.2
change in External Banking Assets (Net)	0.8	0.3	130.0
	<u>1965</u>	<u>1970</u>	<u>1976</u>
Investment 3/	-	18.9	16.2
Domestic Savings 3/	-	15.8	13.9
Government Revenue 3/	23.3	28.0	20.4
Rs/U.S.\$	4.76	5.95	8.46
Rs/SDR	4.76	5.95	9.76
Trade Balance (Rs. Mn.)	-5	-316	-710
Current Account Balance (Rs. Mn.)	-47	-393	- 50

1/ = % current factor cost prices

2/ = current prices

3/ = as a per cent of GDP

Source: Annual Reports of the Central Bank of Sri Lanka.

On the whole, between 1960 and 1977 the administratively controlled monetary and credit policy package was implemented as a remedy for BOP problems and domestic price instability. Most policy instruments were geared to provide BOP support. Policy thinking was guided by the fact that imports should be restricted and domestic supply be promoted through SCCs. In this regard, broader policy instruments

such as exchange rates and interest rate policies were not considered important. Import controls were chosen to reduce the huge outlay on imports while the SCCs were used to promote exports and implicitly, import substitution. The changes in the economic environment, policy thinking in an administrative framework and ideas on the working of the MTM were largely responsible for monetary and price instability observed by the end of 1976. It may however, be added that when compared to the 1950-1959 period there had been a better co-ordination among the policy making authorities, although the support from the fiscal front was minimal. CR and SCCs also had their adverse effects due to inefficient allocation of resources and the circumvention of ceilings by the private sector with respect to bank borrowings. It is also important to note that over-reliance on SCCs and the CR channel inhibited the growth of a dynamic and an outward looking financial structure. The banking sector was allowed to play a limited role in providing banking services and they were not aggressive in mobilizing resources; which was reflected in the shortfall of loanable funds. On the other hand, the intensification of the SCCs enhanced the demand for funds primarily for speculative purposes and the building up of stocks. This was further aggravated by the short supply of goods and services and restrictions on imports.

Over this period, the interest rate was used only as the price of capital, but not as an instrument to re-

store stability. Despite the low interest rate policy designed to provide cheap credit investments remained at relatively low levels due to several other adverse factors, such as, administrative controls, fear of nationalization and rigid controls on imports. Therefore, the low interest rate policy not only failed to promote investment but also adversely affected the activities of the private sector due to the preemption of credit by the government at cheap rates through the rupee securities and Treasury bills.

SRRs were used to limit the credit creating capacity of commercial banks but the till cash concession moderated the effectiveness of this instrument. OMO was not considered as an effective instrument to absorb excess liquidity. Instead, SCCs and the CR were used as major instruments to contain credit to the private sector while the government continued to preempt credit from the banking system. Despite determined efforts, the absorption of excess liquidity was not very successful due to the relative ineffectiveness of policy instruments. Moreover, SCCs and the CR were ineffective in arresting demand pressures which emanated from the supply constrained economy. By 1976, monetary and price developments indicated considerable instability which in fact, called for concerted and effective action in which monetary policy was expected to play a more aggressive role.

3.2.3 Towards Mature Monetary Management: 1977-1985

There was a fundamental shift in Sri Lanka's overall development strategies in November 1977 when it launched a new policy package based on liberalized economic policies. The basic objective of the policy stance was to lay the foundation for rapid and balanced economic growth. The initial adjustment package included the dismantling of direct controls on prices, imports and external payments, retrenchment of government operations in processing and distributing basic commodities, provision of adequate incentives to producers, and the adoption of a flexible exchange rate policy. This policy package was supported by two stand-by arrangements with the IMF (4th quarter of 1977-1978 and during 1983) and the Extended Fund Facility (EFF) covering the period 1979-1981.

The ambitious fiscal policy accompanied by a heavy investment programme required a large sum of funds from the domestic economy. In this context, there was a greater need to provide BOP support through monetary policy measures. Moreover, the monetary and price instability experienced during the previous year called upon monetary policy to play an aggressive role to restore stability. In 1976, M1 rose by 35 per cent, while broad money M2 grew by 32 per cent. The substantial growth in external banking assets (net) and a sharp increase in domestic credit were the principal factors underlying the monetary expansion during

1976. Confronted with these problems, monetary policy had to be designed to achieve the objectives of the post-1977 economic reforms. This required several policy measures. One of the salient features in the formulation of monetary policy was to influence the MTM through the interest rate channel and to deviate from the CR and administrative controls that existed prior to 1977. This reflected a major shift in thinking with respect to the working of the MTM and the choice of techniques in monetary management.

For convenience, the post-1977 period is categorized into two sub-periods: 1977-1981 and 1982-1985. The restoration of money and price stability was the main objective during the first period while establishing a base for longer term economic growth was the prime concern during the latter period. A common objective during both periods was to develop the money market and promote the financial structure, which forms an important part of the broader objectives of national economic policy, namely, to bring about a sustained growth in output, employment and investment. As explained in Jayamaha (1986 a) the key role of the Central Bank was to provide a monetary environment conducive to the attainment of these objectives.

a. Restoration of Stability: 1977-1981

Between 1977 and 1978, the external environment was subject to pressure arising from high inflation and growing imbalances in external payments among the major industrial

countries. This led to turmoil in international currency markets centering on the marked weakening of the U.S. dollar. Protectionist sentiments in industrial countries also threatened to increase according to Bank Negara Malaysia (1984).

On the domestic front, rapid monetary expansion presented formidable problems of demand management. Since excess growth in the money supply was not counteracted by a parallel growth in domestic production, this exerted upward pressure on prices. The liberalized trade policy introduced after several years of restrictions triggered an increase in the demand for imports leading to BOP problems. In response to these developments, monetary policy measures initiated in 1977 continued to be in force during 1977-1981. Policy thinking at this stage centered around the view that stability is a precondition for economic growth. The policy instruments therefore, included inter-alia, increases in interest rates (the raising of the BR and the introduction of a penal rate), quantitative restrictions on accommodation to commercial banks, raising of SRRs, OMO, the introduction of SCCs, credit planning and moral suasion.

As far as interest rate policy was concerned, the interest rate was considered as an effective channel for the monetary transmission process. The objectives of the high interest rate reform were several fold. First, it aimed at ensuring positive rates of return on deposits,

thus promoting financial savings. Second, the interest rate was used to reflect the true cost of funds, thereby arresting the growing demand pressure and discouraging the demand for non-essential credit. Third, high interest rates were expected to determine the price of capital through market forces. The administratively fixed interest rates prior to 1977 were seen as a deterrent to the growth of sub-markets and therefore, the development of a market-oriented interest rate system was designed to respond more promptly and efficiently to changing market conditions. In August 1977, by raising the interest rates of the National Savings Bank (NSB), the money market was guided to increase deposit rates. The commercial banks and finance companies followed suit. The increase of the BR and the introduction of the penal rates (PRs) were used to set the pace with respect to lending rates. By end 1977, therefore, the entire interest rate structure was raised to a higher plateau^{4/}. The effectiveness of this policy on monetary and price developments was illustrated by the annual increases in the narrow money supply dropping below 30 per cent by end 1977, to 11 per cent in 1978, and 6 per cent in 1981. In terms of the major macro economic aggregates the Sri Lankan economy recovered sharply in 1978 from the depressed conditions of the previous years and was poised for further expansion in 1979 and 1980 (see Appendix Table 3.1).

We turn now to the effectiveness of the monetary policy package introduced in the post 1977 period.

Despite the enforcement of the restrictive monetary measures, money and price developments were not consistent with the performances of the real sector during the latter half of 1979 and throughout 1980. The policy stance, therefore, was directed at rationalizing the existing package and improving its effectiveness. Central Bank accommodation to commercial banks was reduced and the graduated scale of penal rates was raised to a higher range of 15-25 per cent per annum in 1979. To take an overall stock of liquidity and to safeguard the interests of depositors, the activities of finance companies were brought under control by the Finance Company Act of 1979. Moreover, the international economic and financial environment in the early 1980's posed new challenges to the conduct of monetary policy. The world economy in this period was characterized by a severe and prolonged global recession accompanied by high energy prices in the wake of the "second oil shock" of 1979-80, and severe global inflation stemming from price pressures and persistently high interest rates. See the IMF Survey (1982). In these circumstances, monetary management had not only to counter the dampening effects of world recession, especially the potential contractionary impact on domestic liquidity emanating from a weakening external sector, but also to maintain monetary stability in order not to fuel further inflation or to worsen the BOP. These considerations and large budget deficits required monetary policy to be selectively accommodative in its

overall stance and to encourage the growth of private sector investment.

Problems on the domestic front were also important. To begin with, deficit financing by the government through borrowings from the banking system increased liquidity in the system in the two years ended 1980. There was also heavy pressure from the private sector for bank funds as vehicle importers were given fiscal incentives to import used vehicles under the Lump Sum Depreciation (LSD) Facility. Despite the reduction in accommodation under the BR and the increase of penalty rates, commercial banks continued to depend on Central Bank funds at high PRs.^{5/} During the latter half of 1980, while external assets exerted moderate pressure, domestic assets rose to unprecedentedly high levels, largely due to the lack of fiscal support to continue with the monetary policy package launched in 1977. Activities of both government and the private sector, resulted in a growth of domestic credit by 72 per cent in 1980 (see Appendix Table 3.1).

Secondly, in 1980 the economy clearly displayed problems associated with the liberalized economic policies introduced earlier. Financial support given by the IMF through an EFF came to a halt since performance under the programme did not comply with the initial objectives. This situation not only questioned the efficacy of monetary policy instruments but also emphasized the need for a coordinated macro-economic policy framework if the country

was to achieve its stability and development objectives. Further tightening of monetary policy measures without adequate fiscal discipline proved to be counter-productive. As the "crowding out" effect already preempted funds by the government from the banking system, heavy demand for credit by the private sector exerted liquidity constraints on banks. Despite the build-up of deposits through high interest rates, banks were unable to cater to the rising demand and hence, resorted to borrowings from the Central Bank at high PRs thus raising reserve money (RM). The M2 multiplier rose rapidly from 2.8 to 3.2 and consequently, M2 rose by 32 per cent in 1980. Reflecting these developments, the CCPI rose by 25 per cent indicating the continuation of double digit inflation, while the returns on financial deposits remained at negative levels throughout 1980. This situation casts doubts on the efficacy of the interest rate instrument as it was unable to restore price stability on the one hand, and mobilize domestic savings at desirable levels on the other. While monetary policy was confronted with domestic financial instability, the real effective exchange rate appreciated in the two years ended 1981. The need to absorb excess liquidity through effective OMO was greater. This called upon the government to make concerted efforts to reduce budget deficits, reschedule the massive investment plan on a priority basis and to reduce dependence on Bank funds.

Since 1981 there has been a more coordinated policy package and a more restrictive approach beginning in the first half of 1981. Since late 1980 both M1 and M2 (M1 + time and savings deposits of the public held with commercial banks) were considered as monetary targets. The high interest rate policy and the public's resort to interest-bearing financial assets and the quickened pace of FI fundamentally altered the character of the public's monetary assets and, therefore, strengthened the case for using M2 as an intermediate target.

Second, in view of the enhanced liquidity, setting out money and credit targets was seen as necessary. For the first time, the Central Bank prepared a National Credit Plan (NCP) in 1981. Based on the available resources in the system (Monetary Survey) and planned credit disbursements of commercial banks, the NCP set out money and credit targets. This enabled the Bank to initiate prompt action where the growth paths of these aggregates deviated from targets. The NCP also helped to channel bank credit to predetermined priority sectors and was supplementary to the existing demand management policy measures. The announcement of the withdrawal of the LSD facility for vehicle importers at end March 1981 resulted in an unprecedented demand for credit by the private sector during the first quarter of 1981. Therefore, as a third policy measure within the coordinated policy framework, the Central Bank introduced a short term credit ceiling effective 11th May, 1981

on the private sector to bring down domestic credit. The BR was raised from 12 to 14 per cent per annum in the 2nd half of 1981 and accommodation under the BR was reduced to Rs.108 million. The penal rate structure was raised from a range of 20-30 per cent per annum to a range of 21-30 per cent per annum. The SRR on demand deposits was raised from 12 to 14 per cent while the ratio on time and savings deposits was raised to 6 per cent per annum. This was further augmented by the introduction of the Secondary Treasury bill (STB) market through which the Central Bank conducted limited OMOs. These measures together helped to absorb excess liquidity and reduce the credit creating capacity of commercial banks.

By 1981 these reforms had achieved a reasonable degree of price and monetary stability^{6/} largely due to concerted efforts in all policy areas and greater fiscal discipline. Towards the end of 1981, although inflationary tendencies were visible, monetary expansion had stabilized and was no longer a significant source of inflationary pressures.

Although the major thrust of monetary policy introduced during 1977-1981, as outlined above, was the control of the aggregate demand and excess liquidity in order to restore stability and create an atmosphere conducive to investment and economic growth, the desirability of supply management policy was not altogether ignored during this

period. To support priority sectors, the Central Bank took several initiatives after 1977. Among these, the introduction of a Pre-shipment Export Credit Refinance Facility and the enhancement of funds available under this facility from Rs.100 million in 1977 to Rs.590 million by end 1981 were significant. The interest rate instrument was also used selectively to provide concessionary finance to priority sectors under several refinance schemes. The provision of long term capital through the establishment of development banks also received priority during this period, including the establishment of the National Development Bank (NDB) to finance project loans and other medium and long term industries and the amalgamation of the Agriculture and Investment Credit Corporation (AICC) and the State Mortgage Bank (SMIB) in 1979. These supply promotional initiatives taken by the Central Bank were supported by the availability of funds under the IMF stand-by programme.

It is important to emphasize the significant features of the monetary policy stance during 1977-1981. First, there was a clear departure from the administrative controls and in particular, the CR and the SCCs that were frequently used prior to 1977. Instead, the cost of credit was raised to discourage non-essential borrowings whilst channeling credit to needy sectors. The second was that only after 1981 was there a concerted coordination between monetary, fiscal and exchange rate policies.

b. Development Efforts and Surveillance on Stability:
1982-1985

Having achieved a reasonable degree of monetary and price stability by end 1981, the promotion of the supply side, while keeping stability under close surveillance, was the prime concern during this period. A second objective was the development of the money market and the financial structure. Adverse effects of high interest rates, in particular, the high cost of credit were reflected in the low level of activities of the private sector. 1982 being an election year, recorded only a few changes in monetary policy. However, it was considered desirable to revise downwards the interest rate structure with a view to introducing greater flexibility and establishing more market oriented rates.

The immediate objective of the monetary authorities was to restore stability prior to growth. 1983 posed several problems for monetary management. In the first half, government borrowings from the banking system were at moderate level. However, the pent up demand for credit from the private sector following political stability after the election, and the enhanced demand for working capital in the tea sector in late 1983 raised private sector credit to very high levels. Confronted with an unexpected overshoot of its money growth targets, the Central Bank wished to restore stability before addressing development issues and therefore, in late 1983 a short term credit ceiling was

introduced. Simultaneously, the availability of funds to commercial banks under the PRs was withdrawn.

Secondly, during the first half of 1983 demand for M1 balances and bank reserves was high. Credit demand was also strong following the reduction in interest rates. As a result, a supplementary refinance facility was introduced to provide relief to non-traditional exports. The immediate objective of this move was to increase the competitiveness of non-traditional exporters as the exchange rate was not adequately remunerative.

In general, monetary policy during the two years ended 1985 was aimed at supporting economic growth. The basic stance of monetary policy was to emphasize the promotion of domestic savings, a better balance between national savings and investment as well as a viable BOP situation. Consolidation of the government's financial position and maintaining an "even keel" in monetary conditions, were considered as important aspects in effecting structural adjustments but, did not receive adequate support at the implementation stage. In addition, a gradual reduction in interest rates remained a desired objective. Both components of the money supply i.e. the RM and mm were considered as ITs with equal importance. To make monetary policy more effective, a combination of general and SCCs^{7/} were used in more complex situations. SCCs were used to contain the non-essential demand for funds on the one hand, and ensure adequate credit for priority sectors on the other.

These measures helped to reduce private sector credit from 20 per cent in the first quarter of 1984 to 17 per cent by the end of the year (see Appendix Table 3.1). However, credit expansion in 1985 was rapid and much stronger in relation to GDP growth. Both money and credit multipliers^{8/} dropped due to the sharp deceleration in external assets and absorption of excess liquidity through OMO.

Appendix Table 3.1 shows the behaviour of the major macro economic aggregates during the 1977-1985 period. As seen from the table, the two years ended 1985 were characterized by a deceleration of prices. The prospects for further oil price declines helped dampen inflationary expectations and the market responded positively to increases in food supplies. The drop in inflation (9.5 per cent in 1984 and further to 1.5 per cent in 1985) was further illustrated by the drop in income velocities of both narrow and broad money from 9.3 and 3.5 in 1984 to 8.6 and 3.2 respectively, in 1985 suggesting that the high growth in M1 in 1985 did not imply the same inflationary potential as in the past.

Towards the end of this period several monetary policy measures were taken to promote growth objectives. To lower the interest rate structure the Central Bank set the pace with a reduction in refinance rates in early 1985 and the BR later in the year. Money market conditions were easier so that interest rates continued to move downwards

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during 1985. The gradual decline in interest rates appeared to have stimulated (with the usual lag of some months) a sizable increase in the demand for M1 and gradual shifts of quasi-money and liquid funds out of money market instruments. The two years ended 1985 experienced mixed results in monetary management. Despite forceful monetary policy measures, liquidity and money incomes remained at undesirable levels and government fiscal operations placed heavy reliance on the banking system largely due to the drop in export revenue and heavy defense expenditure. Although economic conditions began to deteriorate, the emerging civil unrest prevented appropriate and timely policy responses. Therefore, efforts to reduce the fiscal deficit, to provide more resources for investment and to reduce pressure on monetary policy did not become a reality.

3.3 Development Of The Financial Structure

It is important to highlight the steps taken to promote the financial structure within the monetary policy package due to its importance in the process of transmitting monetary policy to the rest of the economy. Although adverse international and domestic economic and financial conditions preoccupied monetary management in the post 1977 period the Central Bank was mindful of the need to develop and strengthen the financial structure to cope with new challenges faced by the economy. Development of the finan-

cial structure was also expected to facilitate the working of the MTM and the Bank played a prominent role in this regard after 1977. The fastest development in the banking sector took place during 1977-1985 following the introduction of new economic policies including greater competition in the banking industry. To encourage foreign investment and trade, branches of internationally reputed foreign commercial banks were allowed to commence operations in Sri Lanka. Secondly, existing banks were encouraged to expand their branch network and further banking services. In addition, the Central Bank opened three regional offices to promote regional banking and a network of unit banking was introduced through Regional Rural Development Banks (RRDBs). The branch expansion had considerable feedback on monetary policy in that the mobilization of resources into the institutional network was important. Accrual of resources to the NSB considerably reduced the pressure on the banking sector's funds for government operations and the expanded branch network also helped to reduce transactions of ICMs and further the banking services in outstations.

Monetary policy also supported dynamism in the banking industry. The liberalized economic policies and the associated trading activities necessitated sophisticated banking in Sri Lanka. For details see Jayamaha (1985). The rapidly growing export/import trade demanded specialized banking services while the growing economy needed flexible attitudes towards risky lending. For example, limited off-

shore banking was introduced in 1979.

Attractive concessions were also made available under the "Non-Resident Foreign Currency Accounts" (NRFC) scheme and the "Special Accounts". Finally, the Central Bank encouraged the establishment of "Merchant Banks" in the early 1980s as a new dimension primarily, aimed at providing financial consultancy and facilitating ancillary services in the banking sector (Jayamaha and Jayatissa, 1984).

It seems, therefore, that the open economic policy adopted after 1977 and the support given through monetary policy largely contributed to innovations in the banking industry. These developments no doubt challenged monetary policy in dealing with the emerging problems. In addition to the easing of the transmission process, FI also helped to contain RM at desired levels as emerging short term outlets provided funds for those who needed them. By end 1985, the monetary and banking environment in Sri Lanka had been transformed radically under the auspices of aggressive monetary policy resulting in a greater degree of financial intermediation.

3.4 Summary and Concluding Observations

In adopting strategies for monetary policy over the past three and a half decades, we observed that the authorities were confronted by a number of basic issues. These

included - the lack of fiscal discipline, the slow adjustment of the exchange rate in pursuit of monetary policy objectives, the establishment of stability prior to growth and the choice of policy instruments in affecting the transmission process. In addition, there were problems arising from adjustments needed to cope with FI and from the essentially ad hoc nature of monetary policy.

Secondly, although confronted with the above problems, monetary management in Sri Lanka over the last 35 years gathered considerable experience and progressed towards maturity. A relatively easy monetary policy stance was adopted throughout the 1950's and monetary measures were basically accommodative. The role of monetary policy was confined mainly to promote stable monetary conditions consistent with the growing needs of an expanded economy and maintaining the purchasing power of the national currency. In the pioneering years, monetary policy was complementary to fiscal policy which held the main responsibility for implementing the stabilization programme of an emerging nation. Traditional central banking advocated "stability" as the prime concern and therefore, the use of general and quantitative type monetary policy measures were considered adequate. On the other hand, monetary and credit expansion remained moderate and price developments were at reasonable levels. Monetary policy was not concerned about the development of the financial structure as an objective of monetary policy and hence, problems associated with the FI did

not arise.

We noted that the period 1960 to 1976 was characterized by administrative controls, restrictions on external payments and the accommodation of the growing financial needs of the government under the controlled regime. Monetary policy was called upon to fall in line with these policy prescriptions thus establishing a reasonable degree of co-ordination among the major macro economic variables. As the 1960's progressed, the country was faced with economic problems including slow economic growth and external financing constraints. Often, fiscal deficits were high and the exchange rate was out of line. Although fiscal policy maintained the key role in economic development, monetary policy was accorded more responsibility to deal with related problems. The market mechanism was suppressed by controls and there was no FI. CR was considered as the major vehicle for the MTM. The outcome of the policies pursued during the 1960's was illustrated by the high rate of expansion of money and credit displaying greater financial instability. The extensive use of CR and SCCs not only resulted in counter-productive results as the economy experienced severe imbalances in demand and supply but also did not allow the establishment of systematic effects in the short run. The disruption of the working of the market mechanism resulted in an irrational allocation of funds as these sectors have not contributed to significant changes in the economic structure.

We observed a clear departure from this policy stance to a more aggressive and an open policy package in 1977. This was a landmark in the history of monetary policy in Sri Lanka. Liberalized economic policies and ambitious investment plans by the government posed numerous problems for monetary policy. Some of these were contained effectively through monetary policy which thus displayed a greater degree of maturity. Experience drawn from the past helped the monetary authorities to act more cautiously and to formulate policies in keeping with national priorities. Monetary targets were set within this framework and in many instances appropriate measures were used to achieve the objectives. The over-ambitious investment programme of the government however, reduced the efficacy of monetary policy instruments that were in force during the first few years after 1977.

Monetary policy underwent several radical changes during the period 1977-1985. Having gone through the accommodative 1950's and rigid controls in the 1960's a wide array of monetary policy measures were used to come to grips with emerging problems. While this chapter reviewed the specific issues that monetary policy was confronted with, it has also attempted to highlight the lessons to draw from the past.

The first lesson to note is that the fiscal restraint is a necessary component of economic adjustment

strategy and effective monetary management. Throughout the 35 years ended 1985, monetary policy has been very effective in those years in which fiscal policy displayed a greater discipline. It is also important to note that undue restraints introduced through monetary policy measures due to lack of fiscal discipline has led to underperformance of the economy, particularly during the 1960s and in 1980 and 1985. Moreover, there has been no proper timing with respect to borrowings from the banking system. A second lesson refers to the fact that the enhancement of refinance facilities to the private sector, although increasing the RM, had to be continued in order to make exporters more competitive. A reasonable intermediate objective of any changes to the present exchange rate system would be to maintain enough flexibility in real exchange rates to aid external adjustment.

A third lesson to draw from past experience is to treat the development of the financial structure as an important objective which would mobilize greater savings in the economy if sustained production is to be financed. In the process, maintenance of public confidence in the financial structure is crucial. During the 1950's no attention was paid to this aspect of monetary policy and the controlled system in the 1960's was also not conducive to the development of the financial structure. The period 1977-1985 was characterized by considerable FI and today there is not only a diversified and competitive financial struc-

ture, but a system that is capable of transmitting monetary policy action to the other sectors in the economy.

Finally, and perhaps most important of all are the difficulties experienced in monetary policy formulation as a result of working without a coordinated framework. Problems confronted by monetary management in the 1950's were simpler than those of the 1960's, and thereafter. Being a newly established Central Bank, monetary policy could not have foreseen complex situations and worked within a coordinated framework. The 1960s and the early 1970s saw a concentration on ad hoc measures within the framework of controls. Despite recognition of the fact that monetary policy could be made an effective tool of demand management, complemented by fiscal discipline, money's role in economic activities was not properly established, even during the 1977-1985 period. To gather prior information as to how related variables react to policy measures it is important to set intermediate and operational targets which are linked to ultimate targets. Had this aspect received adequate attention, an MCF for the conduct of monetary management might have been developed. Although monetary targets were set from 1981 onwards through the NCP and interest rates were consistently used as a vehicle of the MTM, progress was not reviewed at regular intervals in order to monitor the smooth working of this channel. Targets have not been set on RM and therefore, there was no OTs which reflected the behaviour of the ITs.

The MCF that will be developed in later chapters will focus on how monetary policy instruments might affect real variables in the economy. This will help us to show how monetary policy measures might be initiated in the context of an established framework which would provide guidance to monetary management.

Foot Notes

1. The main data source for this historical review are the Annual Reports of The Central Bank of Sri Lanka.
2. In August 1985 the name of the Central Bank of Ceylon was changed to The Central Bank of Sri Lanka.
3. The growth of prices for 1950 and 1951 is calculated using 1939 as the base year (1939=100).
4. The weighted average of commercial banks' lending rates rose from 9 per cent in 1976 to 12.8 per cent by the end of 1978.
5. In 1980, the penal rate structure was further raised to a range of 20-30 per cent per annum.
6. M1 and M2 rose by 6 per cent and 23 per cent, while the CCPI rose by 18 per cent in 1981.
7. Banks were allowed to expand credit by not more than 5 per cent of such advances granted and outstanding as on 11th May, 1984 until further notice.
8. Money multiplier dropped from 1.23 to 1.15 and credit multiplier from 2.96 to 2.65 during 1985.
9. The twelve month fixed deposit rate (at maturity) was reduced from 20 to 18 per cent per annum.

Appendix 3.1

Major Macro Economic Indicators 1977-1985

	1977	1978	1979	1980	1981	1982	1983	1984	1985
<u>National Income</u>									
% Growth in GDP (real terms)	4.2	8.2	6.3	5.8	5.8	5.1	5.0	5.1	5.0
% Growth in GNP (real terms)	4.4	8.8	6.4	5.6	4.1	4.8	4.0	5.1	5.3
% Growth of per capita GNP (current prices)	22.1	14.8	20.7	22.5	23.9	14.0	17.6	22.0	4.5
<u>Prices</u>									
Colombo Consumer's Price Index point to point (% change)	1.5	17.0	14.7	24.7	18.3	5.3	21.4	9.5	1.5
Wholesale Price Index point to point (% change)	24.6	7.7	16.2	32.3	14.2	0.6	43.5	5.3	-18.2
<u>Money and Credit</u>									
% Change (M2)	37.9	25.0	38.2	31.9	23.1	24.8	22.1	16.6	11.5
% Change (M1)	28.8	10.6	29.2	22.9	6.3	17.3	25.4	14.1	11.5
% Change in Domestic Credit	21.0	21.7	40.3	72.3	31.6	24.8	16.3	1.3	18.6
% Change in External Banking Assets (Net)	3315.5*	50.8	21.8	-46.7	-19.0	-19.3	34.4	212.7	-6.9

Contd.....

<u>Contd.</u>	1977	1978	1979	1980	1981	1982	1983	1984	1985
<u>Investment Savings</u>									
Investment as a % of GDP	14.4	20.1	25.8	33.8	27.8	30.8	28.9	25.8	23.8
Domestic Savings as a % of GDP	17.0	15.5	14.7	14.0	14.0	15.4	16.4	21.6	15.3
National Savings as a % of GDP	19.4	15.5	14.8	14.0	14.3	15.3	16.4	22.2	14.2
<u>Government Finance</u>									
Govt. Expenditure as a % of GDP	28.1	46.6	43.2	48.7	39.2	40.0	41.1	38.3	43.6
Govt. Revenue as a % of GDP	19.3	28.9	25.6	22.6	20.4	18.8	22.7	26.9	26.3
<u>Exchange Rates (Average)</u>									
Rs/US\$	9.15	15.61	15.57	16.53	19.25	20.81	23.53	25.44	27.16
Rs/SDR	10.42	19.58	20.13	21.52	22.67	22.98	25.16	26.08	27.63
<u>Balance of Payments (Rs Mn)</u>									
Trade Balance	+ 350	-2393	-7288	-16312	-15616	-20403	-20168	+11850	-19801
Current Account Balance	+1266	-1032	-3556	-10912	- 8498	-11844	-11122	- 1400	-11407
Overall Balance	+3313	+1861	+ 793	- 2967	- 406	- 1009	+ 342	+ 7062	- 1060

Sources : Central Bank Annual Reviews, IFS, Monthly Bulletins of the
Central Bank of Sri Lanka

* Amount in Rs. Million

APPENDIX 3.2

Monetary Policy Measures. 1977-85

Date	Instrument/Measure Taken
January 1977:	<u>Interest rates</u> ; Bank rate was increased from 6.5 per cent to 8.5 per cent year.
July 1977:	<u>Rediscount facility</u> ; for commercial bank was restricted to 7 per cent of selected assets outstanding on 6/30/77, and excess became subject to penalty rate of 15 per cent per annum for first 30 days and an additional percentage point per annum for each additional 30-day period.
August 1977:	<u>Interest rates</u> ; Bank rate was increased from 8.5 per cent to 10 per cent per year.
September 1977:	<u>Interest rates</u> ; NSB deposit rates raised sharply and, as a result, commercial bank deposit and lending rates were revised upward correspondingly.
November 1977:	<u>Rediscount facility</u> ; limits were reduced from 7 per cent to 4 per cent of selected assets outstanding on 7/30/77.
December 1977:	<u>Refinance credit</u> ; limit for export financing was raised by SL Rs 100 million.
December 1977:	<u>Reserve requirement</u> ; till cash phased out as approved reserve account.
March 1978:	<u>Selective credit ceilings</u> ; on commercial bank credit to non-bank companies engaged in lending and hire purchase were relaxed to exclude financing of capital equipment and commercial vehicles.
June 1978:	<u>Selective credit ceilings</u> ; on commercial bank credit to government corporations and statutory boards at 6/2/78 levels.
July/August 1978	<u>Selective credit ceilings</u> ; introduced on government corporations and statutory boards in June 1978, were adjusted upward 5 per cent and 12 per cent.

September 1979: Rediscount facility; central bank credit in excess of quotas became subject to gradual penalty rate scale from 15 per cent to 25 per cent per annum, depending on amount of excess. Total quotas were increased by SL Rs 210 million for export credit refinancing; individual banks' quotas were based on outstanding assets on 12/31/78 and 6/30/79.

September 1979: Selective credit ceilings; on commercial bank credit to government corporations and statutory boards were withdrawn.

April 1980: Interest rates; were increased: Bank rate from 10 per cent to 12 per cent per annum; Treasury bill rate from 9 per cent to 13 per cent per annum; Government securities rate from 10 per cent to 16 per cent per annum; and deposit rates of the NSB and commercial banks were revised upward.

April 1980: Refinance facilities; export credit refinance facilities were increased by 15 per cent (to SL Rs 230 million).

January 1981: Refinance facilities; export credit refinancing facilities were increased from SL Rs 230 million to SL Rs 530 million, and allocated among banks based on such credit on 3/31/80 and 6/30/80.

January 1981: Rediscount facility; quotas for general accommodation of banks were reduced from 4 cent to 3 per cent of selected assets on 8/31/80, or from SL Rs 473 million to SL Rs 462 million.

April 1981: Open Market Operations; Central Bank began resale of Treasury bills from its portfolio at rates above call market rates (net resale of Treasury bills was at Rs 684 million in 1981).

May 1981: Overall credit ceilings were imposed on commercial banks at 5/11/81 levels until 5/25/81, and at 3/31/81 levels thereafter.

June 1981: Overall credit ceilings; were removed on 6/1/81.

June 1981: Rediscount facility; total quotas for general accommodation were reduced from SL Rs 462 million to SL Rs 108 million with a minimum of SL Rs 1 million per bank.

June 1981: Reserve requirements; were raised from 12 per cent to 14 per cent of demand deposits, and from 5 per cent to 6 per cent on time and savings deposits.

August 1981: Interest rates; were increased: Bank rate from 12 per cent to 14 per cent per annum; and Bank penalty rates from 20-30 per cent per annum to 21-30 per cent per annum.

December 1981: National Credit Plan; was introduced to cover commercial bank credit to private sector and serve as a tool in formulating monetary policy, monitoring credit growth and ensuring adequate credit to priority sectors (exports, industry, agriculture and tourism).

January 1982: Refinance facilities; rates and margins of such facilities were revised upward; refinance under medium- and long-term credit facility was increased from 80 per cent to 100 per cent of project cost; and export pre-shipment credit facility increased from SL Rs 575 million to SL Rs 590 million.

February 1982: Selective credit ceilings; banks were allowed to lend to non-bank companies in excess of the 6/30/76 limit if loan was to be used for capital equipment and commercial vehicles.

June 1982: Selective credit ceilings; introduced in 1962 on bank credit to residents or companies registered in Sri Lanka for the purchase of estates or immovables were withdrawn.

December 1982: Interest rates; the Treasury bill rate in the primary market was allowed to fluctuate within a small margin.

March 1983: Interest rates; were reduced: Bank rate reduced from 14 per cent to 13 per cent per annum; Most central bank refinance rates by one percentage point per annum; and Penalty rate range of 21-30 per cent per annum was replaced by a flat penalty rate of 20 per cent per annum.

April 1983: Refinance facilities; access and bank margins for some medium- and long-term facilities were reduced.

May 1983: Interest rates; yields on government securities were reduced from 16 per cent to 14 per cent per annum, together with an extension of maturities from three years to five years.

June 1983: Refinance facilities; limit for export refinance was increased from SL Rs 590 million to SL Rs 1,200 million while the rates and margins on bank refinancing were reduced by one percentage point (to 10 per cent and 3 per cent per annum, respectively).

September 1983: Refinance facilities; limit for export refinance was increased by 10 per cent to SL Rs 1,320 million.

November 1983: Overall credit ceilings; were imposed on commercial banks (on November 1) at levels outstanding on 10/31/83.

November 1983: Overall credit ceilings; were removed on 11/30/83.

November 1983: Reserve requirements; were increased from 14 per cent to 16 per cent of demand deposits, and from 6 per cent to 8 per cent for time and savings deposits.

November 1983: Rediscount facility; accommodation at penalty rate was reduced as percentage of collateral and subsequently all accommodation at penalty rates was discontinued; rediscount quotas for banks were to be used only on a temporary basis.

December 1983: Reserve requirements; of 16 per cent were introduced on unutilized overdrafts.

March 1984: Refinance facilities; the facility for the Paddy Marketing Board was limited to SL Rs 400 million, and its refinance rate was raised by two percentage points per annum.

March 1984: Rediscount facility; was withdrawn altogether.

March 1984: Refinance facilities; the export pre-shipment facility was increased by the amount withdrawn for general accommodation, or SL Rs 108 million, and was further increased by SL Rs 350 million to finance higher tea exports; the new limit for the facility was SL Rs 1,778 million.

March 1984: Forward sales of export receipts; all exporters were obliged to sell forward 90-day exports over SL Rs 0.5 million. Where pre-shipment refinance was used, the forward sales requirement was reduced to 60 days.

March 1984: Refinance facilities; an Interest Rebate Scheme was introduced as an incentive for exporters to repatriate their proceeds; refinance rates for traditional and non-traditional exports were raised from 10 per cent to 13 per cent per annum, and from 7 per cent to 10 per cent per annum, respectively, and on-lending rates from 13 per cent to 16 per cent and from 9.75 per cent to 12.75 per cent per annum with an interest rebate of four percentage points per annum.

April 1984: Open Market Operations; the Central Bank began to issue its own securities in an effort to "mop up" liquidity; in 1984, SL Rs 557 million of such securities were sold.

May 1984: Selective credit ceilings; were introduced on loans and advances to the private sector excluding exports and agriculture; the ceilings were set at 5 per cent above such credit outstanding on 5/4/84.

June 1984: Selective credit ceilings; were introduced on credit for nonessential imports (all imports except food and foodstuff, raw materials, components and intermediate goods, drugs and pharmaceuticals, books and pamphlets, capital goods and parts thereof) of individual importers at 3/28/84 levels.

September 1984: Minimum liquidity ratio; for finance companies was increased from 5 per cent to 10 per cent of deposits, and they were required to maintain reserves equivalent to 3 per cent of deposits in the form of government or central bank securities.

November 1984: Reserve requirements; special reserves in respect of incremental deposits were introduced according to a reserve tranche system as follows (in per cent):

<u>Increase in deposits</u> <u>over 11/14/85 level</u>	<u>Special reserve</u> <u>requirement on</u> <u>increase in</u> <u>Deposits</u>
up to 3	-
over 3 to 6	5
over 6 to 10	10
over 10	15

January 1985: Selective credit ceilings; on credit for non-essential imports extended to finance companies at 1/1/85 levels.

February 1985: Refinance facilities; rates for pre-export credit reduced from 8.75 per cent to 7.8 per cent and from 12.75 per cent to 11.8 per cent for nontraditional and traditional exports, respectively.

June 1985: Minimum liquidity requirement; for finance companies was raised from 10 per cent to 15 per cent of deposits applicable on any one day.

June 1985: Reserve requirements; for time deposits could be met, up to 12.5 per cent of such reserves required, by holdings of special bonds issued by the DFCC (yielding 7 per cent per annum); at end-1985 banks held SL Rs 333 million of such bonds.

August 1985: Interest rates; yields on government securities were reduced from 16 per cent to 14 per cent per annum for maturities of six years.

September 1985: Reserve requirements; were raised from 16 per cent to 18 per cent for demand deposits, and from 8 per cent to 10 per cent for time and savings deposits, except time deposits of less than 90 days, for which the requirement was raised from 8 per cent to 14 per cent.

September/
December 1985: Interest rates; yields on Treasury bills were reduced from 14 per cent to 11.5 per cent for primary issues, and from 14-14.2 per cent to 11.3-11.5 per cent per annum in the Central Banks' secondary window.

December 1985: Interest rates; Bank rate (not operational) and all refinance rates were reduced by 2 per cent per annum.

CHAPTER 4

THE ESTIMATING MODEL

4.1 Previous Research

There has been relatively little research on the Transmission Mechanism of monetary policy in developing countries (LDCs) as compared with the voluminous literature available for developed countries (DCs)^{1/}. In particular, Aghevli and Rodriguez (1979), Reichel (1979), Aghevli, et al; (1979), Wijesinghe (1986) and SEACEN (1981) are considered to be relevant for the purpose of this thesis. In this section we present a brief summary of the first three studies and a detailed review of the SEACEN study.

Aghevli and Rodriguez (1979) use a modified monetarist model to analyse the role of monetary factors in the process of short run determination of output, growth, inflation and the trade balance for Japan during the period 1965 to 1976. The theoretical framework is highly aggregative and focuses on the explanation of the behaviour of key economic variables. A dynamic model was estimated for Japan using Ordinary Least Squares (OLS).

The theoretical framework for this study is an extension of Friedman's (1970 a) closed analysis to an open economy and is essentially monetarist. It assumes that the excess supply of real cash balances plays the leading part in the short run adjustment of the economy, but extends the

analysis to an open economy. Following the "monetary approach to the balance of payments", Aghevli and Rodriguez (1979) deal with an open economy by taking into account the trade balance as one of the main endogenous channels through which the public adjusts its actual cash balances^{2/}. By implication, therefore, the effects of excess money supply are reflected in the deterioration of the trade balance. The concept is crucial for many LDCs including Sri Lanka, which is a relatively open economy.

Most empirical work on the monetarist approach is also based on a small country with full employment and recognizes that at least some prices in the economy may not be immediately responsive to world prices. The Aghevli and Rodriguez (1979) model also deals with the concept of potential output which acts as an important self-equilibrating variable. A larger level of excess capacity is assumed to reduce inflation and stimulate output and growth in the long-run.

The Aghevli and Rodriguez model for Japan utilized this basic monetarist structure for empirical research on money's influence on the real economy in South East Asian Countries. The most important contribution of this model is to provide an empirical framework for capturing the institutional peculiarities of many developing countries within the basic monetarist approach. In other words, the excess money supply would lead to increases in domestic prices, output and a deterioration of the trade balance.

The SEACEN (1981) study, Wijesinghe (1986) and the model used in our thesis are adapted versions of this model.

Reichel (1979) attempts to analyse the implications of the specific features of financial markets and their behaviour in developing countries (including Sri Lanka), for the money supply process. He suggests that the fragmentation, ill-developed or non-existence of financial markets, and the practice of fixing principal interest rates in developing countries tend to result in a pattern of financial behaviour which is difficult to capture by conventional approaches to money supply modelling over the short period. In particular, the virtual absence in developing countries of instantaneous adjustment in prices, obscures portfolio behaviour and produces a slower speed of adjustment and a larger than normal deviation from portfolio equilibrium in the longer term.

Reichel (1979) thus attempts to embody the special features of financial markets in a quarterly model for the money supply process in developing countries. A novel feature of the investigation into the forces which determine observed behaviour of variables influencing the money supply is the deviation of Shock Variables for both the non-bank and the banking sector. Shock Variables are introduced to capture the effects of unexpected changes in key variables associated with certain financial instruments. With the help of this model, the effects of changes

in government borrowing from the Central Bank; changes in the rediscount rate and the treasury bill rate; and changes in required reserve ratios and in exogenous components of the monetary base (MB) are analyzed. Simulation is used to highlight the impact of certain monetary policy instruments on the MB and the money multiplier (mm).

Aghevli, et al; (1979) provides an overview of the role of money and monetary policy in South East Asian countries including Sri Lanka. It assesses the constraints imposed by under developed financial markets in conducting monetary policy and the possible adverse effects of certain policy instruments on long-term financial development. It also stresses the structural aspects and the high degree of openness of Asian countries with respect to movements of goods and services and capital. In particular, it stresses the importance of these movements in relation to the size of the economies concerned.

Wijesinghe (1986) models the basic links between major macro economic variables for Sri Lanka over the period 1979-1982 and evaluates the effect of exchange rate and monetary policy changes on output, prices and the balance of payments (BOP). The results show that contractionary monetary policy is effective in improving both the BOP and real income in the long run. According to this study, although the exchange rate was effective in improving the BOP situation over this period, it did not reduce the volume of imports nor improve real income in the

long run. The results, however, are not strictly comparable with our own since Wijesinghe modeled only the real sector of the Sri Lankan economy and used a different time period.

Of particular importance to our thesis is the SEACEN (1981) study which is designed to empirically examine the effects of monetary impulses on growth, inflation and the BOP in individual South East Asian countries. These include Indonesia, Malaysia, Nepal, Philippines, Singapore, Sri Lanka and Thailand. It analyses the effects of monetary policy instruments such as interest rates, exchange rates and open market operations. A simple aggregative econometric model (based broadly on the Aghevli and Rodriguez model for Japan) was developed in order to analyse money's relationship with economic activity. The prime focus is on developments in the economy over the short run when markets are in disequilibrium. Hence, a quarterly model is used. Within this model there are two self-contained and mutually exclusive models: the financial sector model and the real sector model.

The theoretical framework which lies behind the model is based upon a money-goods economy where an excess supply of money as opposed to an excess demand for goods results in higher output, higher prices or a deterioration of the trade balance. The adjustment of output, prices and the trade balance is assumed to depend on the excess money, the degree of openness of the economy and the existing

level of excess capacity. In the real sector model, the money supply is taken to be exogenous. Accordingly, it is assumed that the excess money (M_0) over demand (M_0^d) spills over into the goods market. This will be reflected in an increase in expenditure on domestic and imported goods by the private sector ($M_0 - M_0^d$). The model also implies that the effects of money on output are transmitted via total domestic spending (absorption). Therefore, for any given supply of money the rate of adjustment of actual output towards its potential level is assumed to depend on the excess capacity of the economy.

Imports are determined by the difference between domestic absorption and spending on home goods, the latter in turn is influenced by the prices of home goods, import prices in foreign currency, the rate of exchange, its previous period value, and seasonal dummies. In addition, the change in current spending, when combined with the potential change in current output, provides a measure of demand pressure on the prices of home goods.

A further implication of the model is that given the expansion of output, the larger the change in spending, the greater should be the spill over into higher prices. Given the rate of spending, a larger expansion of output should be associated with less spill over into higher prices. Moreover, because the responses of individuals and firms to changing demand and supply conditions are

typically lagged, current changes in the rate of inflation reflect past growth rates of spending and output.

The main objective of the SEACEN study is to analyse the effects of monetary impulses on growth, inflation and the BOP. Secondly, it explores the money supply process and the impact of monetary impulses and establishes relationships within the context of individual SEACEN countries. In order to provide a basic framework for assessing the consequences of alternative policy decisions, the study is designed in such a way that it could be modified to incorporate individual SEACEN country differences. This study allows the researcher to vary the exact components of the model based upon data availability, empirical evidence and institutional features pertaining to the particular country concerned.

Having considered the basic ideas behind the SEACEN model, the next step is to examine its structure in more detail. This is important because it represents the immediate empirical work from which our own model was derived.

The monetary side of the model highlights some of the major monetary transactions. The money supply in this model is determined by the stock of reserve money (monetary base or high powered money) and the components of the money multiplier (mm). Accordingly, narrow money (NMO) is the sum of currency circulating outside banks (C) and bank

deposits held by the public (D) so that;

$$NMO = C + D \quad \dots (1)$$

The broadly defined money (BMO) includes currency, demand deposits and time and savings deposits of the private sector held with the commercial banks (T).

$$BMO = C + D + T \quad \dots (2)$$

The monetary base (MB) consists of all sight liabilities of the Central Bank.

$$MB = C + R \quad \dots (3)$$

Where R = statutory reserves or excess reserves of commercial banks and C = currency held by the public.

Multiplying the right hand side of the equations (1) and (2) by $MB/(C + R)$.

$$NMO = \frac{C + D}{C + R} \cdot MB \quad \dots (4)$$

$$BMO = \frac{C + D + T}{C + R} \cdot MB \quad \dots (5)$$

$$nm = \frac{C + D}{C + R} \quad \dots (6)$$

$$bm = \frac{C + D + T}{C + R} \quad \dots (7)$$

where nm and bm are narrow and broad money multipliers, respectively.

The demand for money is estimated by three behavioural equations: demand for currency, demand for demand deposits and demand for time and savings deposits. The total reserves equation may be considered either as the demand for statutory reserves or for excess reserves^{3/}.

The monetary sector contains several key monetary policy instruments. Among the direct variables, interest rates and required reserves play a significant role while components of the monetary base form the other variables which can be used as monetary policy instruments. Among them, net credit to government and gross credit to commercial banks and other institutions are important.

In the real sector, domestic expenditure (total absorption) consists of both home and imported goods. Imports are estimated as a behavioural equation where real income and the real price of imports are important variables.

Changes in the gross domestic product deflator reflect past growth rates of prices of exports and domestic goods. Inflationary or deflationary gaps in the traded goods market resolve themselves through net imports as long as foreign borrowing and lending are allowed for the private sector and the government can control the rate of exchange. In the market for non-traded goods, excess demand pressure spills over into higher prices as relatively large quantity adjustments cannot take place in

the short run. Over the long run, however, changes in the level and composition of demand affect the growth of output. The combined effect of these changes provides a measure of demand pressure on the GDP deflator in the model.

A demand determined export function is used to close the model. However, unexpected changes in supply conditions are taken into consideration through the introduction of exogenous variables. The major determinants of the export equation are foreign demand and the relative price of exports.

The money supply process is linked to the real sector via the BOP and MB identities:

$$B = X - IM + CAP = NFA_t - NFA_{t-1}$$

$$MB = NFA + NDA + OIN$$

where:

B = Balance of Payments

X = Exports of Goods and Services

IM = Imports of Goods and Services

CAP = Capital flows, both short term and long term

MB = Monetary Base (Reserve money)

NFA = Net Foreign Assets

NDA = Net Domestic Assets

OIN = Other Items (net)

The implication is that both imports and exports are determined in the real sector. The BOP outcome which is equal to $NFA_t - NFA_{t-1}$ feeds into the monetary sector through MB. In explaining the money supply process the model assumes that the excess of money over the demand for money spills into the goods market. Therefore, the excess money supply affects both prices and private sector expenditure in real terms. Thus, the private sector expenditure function takes the form;

$$PA/P = f [YQ(-1), \frac{M^d}{P}(-1)]$$

where YQ refers to real income and the demand for money function takes the form:

$$\frac{M^d}{P} = f (YQ, \pi)$$

Where π is the expected rate of inflation. By considering these two equations, reduced form equations are obtained for private sector expenditure and the price level .

$$PA/P = f [\frac{M}{P}(-1), YQ(-1), \pi(-1)]$$

$$P = f [\frac{M}{P}(-1), YQ(-1), \pi(-1)]$$

The full model is listed below. Ln refers to natural logs.

Monetary Sector

Behavioural Equations

$$1. \text{Ln } C/cp = a_0 + a_1 \text{Ln} YQ + a_2 \overline{\Pi} + a_3 r_{st} + a_4 \text{Ln} NBO \\ + a_5 \text{Ln } (C/cp) (-1) + a_6 D_2 + a_8 D_3 + a_7 D_1$$

$$2. \text{Ln} D/cp = b_0 + b_1 \text{Ln} YQ + b_2 \overline{\Pi} + b_3 r_{st} + b_4 \text{Ln} NBO \\ + b_5 \text{Ln } (D/cp) (-1) + a_6 D_1 + a_7 D_2 + a_8 D_3$$

$$3. \text{Ln} T/cp = c_0 + c_1 \text{Ln} YQ + c_2 \overline{\Pi} + c_3 r_{st} + c_4 \text{Ln} NBO \\ + c_5 \text{Ln } (T/cp) (-1) + c_6 D_1 + c_7 D_2 + c_8 D_3$$

$$4. R = d_0 + d_1 NBO + d_2 r_c + d_3 (T + D) + d_4 Z \\ + d_5 D_1 + d_6 D_2 + d_7 D_3$$

Identities

$$5. NMO = \frac{C/cp + D/cp}{C/cp + R/cp} .MB$$

$$6. BMO = \frac{C + D + T}{C + R} .MB$$

$$7. MB = NFA + NDA + OA$$

Real Sector

Behavioural Equations

$$8. \text{Ln}(PA/p) = e_0 + e_1 \text{Ln} YQ(-1) + e_2 \text{Ln } (NMO/cp) (-1) \\ + e_3 \overline{\Pi} .(-1) + e_4 D_1 + e_5 D_2 + e_6 D_3$$

$$\begin{aligned}
9. \Delta \text{LnP} &= f_0 + f_1 \text{LnYQ}(-1) + f_2 \text{Ln}(\text{NMO}/\text{cp})(-1) \\
&+ f_3 \pi(-1) + f_4 \Delta \text{LnMP} + f_5 \text{D}_1 + f_6 \text{D}_2 \\
&+ f_7 \text{D}_3
\end{aligned}$$

$$\begin{aligned}
10. \text{LnMQ} &= g_0 + g_1 \text{LnYQ} + g_2 \text{LnMP}/p + g_3 \text{LnMQ}(-1) \\
&+ g_4 \text{D}_1 + g_5 \text{D}_2 + g_6 \text{D}_3
\end{aligned}$$

$$11. \text{LnXQ} = h_0 + h_1 \text{LnXP}/\text{XPC} + h_3 \text{LnXQ}(-1) + h_2 \text{X}^*$$

Identities

$$12. Y = PA + G + XQ \cdot XP - MQ \cdot MP$$

$$13. YQ = Y/P$$

$$14. B = XQ \cdot XP - MQ \cdot MP + \text{CAP} = \text{NFA} - \text{NFA}(-1)$$

Endogenous Variables

C/cp	= Real currency in circulation
D/cp	= Real Demand Deposits.
T/cp	= Real time and savings deposits
R	= Total reserves of the commercial banks
MB	= Monetary Base (Reserve money)
NMO	= Narrow money
BMO	= Broad money
PA/p	= Private sector expenditure in real terms
P	= Price level (GDP deflator)
MQ	= Volume of imports
XQ	= Volume of exports

Y = GDP at current prices
 YQ = Real GDP
 B = Balance of payments surplus
 Z = Vector of cost push factors

Exogenous Variables

π = Expected rate of inflation
 $\pi_t = \gamma P_{t-1} + (1 - \gamma) \pi_{t-1}$ with $\gamma = 0.1$
 NBO = Number of bank offices
 r_{st} = Weighted average of interest rates on time and savings deposits
 r_c = Interest rate which banks must pay to borrow from the Central Bank
 cp = Colombo Consumers' Price Index
 MP = Price of imports
 XPC = Price of competing exports
 XP = Price of exports
 X* = Export capacity generated using a trend line on XQ
 D1, D2 & D3 = Seasonal dummies
 NDA = Net domestic assets
 NFA = Net foreign assets
 OA = Other assets
 CAP = Capital flows

Within the framework of this model a quarterly model is estimated for Sri Lanka for the period 1974

quarter 1 to 1979 quarter 4. Ordinary least squares was used to estimate the equations. The results of the SEACEN/Sri Lanka model are reported in Appendix 4. 1.

Having explained in some detail the SEACEN framework, which is used flexibly by the countries concerned, our next task is to present our estimating model and to explain its relationship to the SEACEN formulation.

4.2 Choice of Model

The specific concern of our study is to provide a framework for understanding the underlying relationships among monetary and real sector variables for Sri Lanka over the period 1977 to 1985 and to assess the effective monetary transmission channels during this period. Accordingly, we utilize a standard monetarist model similar to that used in the SEACEN (1981) study discussed above.

There are a number of reasons why we considered a monetarist framework to be an appropriate basis for our analysis of the MTM in Sri Lanka. To begin with, this perspective is especially relevant since we are concerned with the MTM in Sri Lanka over the period 1977-1985 during which monetary policy was assigned a prime position with an explicit monetarist bias. The introduction of monetary shocks has been fairly regular and was followed by strict implementation procedures. The changes that were introduced

through monetary policy no doubt had significant influences on the performance of both financial and real sector aggregates. Such effects would be seen in the behaviour of monetary and financial variables and therefore, a monetarist type empirical model was considered more appropriate for our purpose. Although it is possible that our model misses out important mechanisms which have been excluded, either because of insufficient data, or because they contradict the principles already assumed within the broad monetarist framework, this can probably be judged in the light of the model's performance later in this thesis.

Secondly, the reliance on a predominantly monetarist perspective is also less of a handicap insofar as there is little significant disagreement between monetarists and Keynesians in respect of the basic theory of the transmission mechanism. Both groups support some version of the portfolio adjustment process as the appropriate framework to describe the effects of monetary policy on the real sector. The SEACEN approach is also flexible enough to accommodate differences of opinion about the MTM within the general portfolio adjustment approach. Many of the differences revolve around the range of assets to be included, the role of interest rates and the technical relationships between stocks of real assets and the flow of real expenditure corresponding to those assets.

Thirdly, using a similar model to the SEACEN study allows us to compare and contrast the validity of a

monetarist model for the two periods, i.e. 1974 to 1979 and 1977 to 1985, although a direct comparison is ruled out due to the modifications introduced in our study.

Fourthly, since this thesis is aimed at providing an insight into the effects of monetary impulses on other variables in the economy and providing an analytical framework within which monetary management could be improved, the use of a monetarist type model would be helpful to highlight the importance of monetary instruments in influencing real sector variables.

Fifthly, and perhaps the crucial reason in practice, is the availability of data which imposed a severe constraint on the type of the model which we were able to build. In particular, the absence of quarterly data for real sector aggregates such as the capital stock, capacity utilization, labour supply and employment, prevented us from testing a structuralist type model in which more attention is paid to real sector variables. We elaborate on this in the next paragraph. Also there was no consistent data series for sectoral expenditure. For example, we tried to separately estimate government and private sector expenditure but we were not successful as the sectoral totals did not add up to the total aggregates.

Finally, it is pertinent at this juncture to examine the relevance of a model based on structuralist theory for Sri Lanka. The key theme of the structuralist

approach is that development is a discontinuous process of structural change. This line of thought was influential in the 1960s in suggesting that development policy requires a big push in investment to escape from "vicious circles of poverty" and attain self sustaining growth with greater emphasis on industrialization. Linked to this was the adoption of an inward looking international trade policy including import substitution and protectionist policies. These ideas were influenced by Chenery and Eckstein (1970) and represented a critique of application of the theory of comparative advantage to the developing countries and reflected a growing pessimism about the prospects for primary product exports in developing countries.

A second important component of the structuralist school was that price stability could only be attained through selective and managed policies for economic growth. It was suggested that the basic forces of inflation were structural in nature and that inflation was essentially a supply phenomenon which could only be remedied by monetary and fiscal means at the expense of an intolerable underutilization of resources. Structuralists did not deny that inflation cannot persist for long without monetary expansion but they regard this as irrelevant because price stability can only be achieved by monetary means at the cost of stagnation and underemployment of resources. Thus the role of financial factors in propagating inflation was not denied, but what was disputed is the idea that

inflation has its origins in monetary factors. In the structuralist view monetary policy would only attack the symptoms of inflation but not the root causes. Owing to the instability of export proceeds and the slower growth of exports relative to the demand for imports, the control of imports in the short run for BOP reasons will result in adverse consequences for growth. For a review of structuralist theory, see Thirwall (1983).

Structuralists also tend to suggest that the BOP is a binding constraint on growth via the supply of foreign exchange needed to finance "essential" imports for domestic industrial expansion. The rationale behind this was derived from "two gap" analysis which has its origin in the standard Keynesian position that export-import gaps are identical ex post and that there is no reason for them to be equal ex ante (in a planned sense). The basic assumption of this analysis is a lack of substitutability between foreign and domestic resources. If foreign exchange savings are scarce it is not easy in the short run to use domestic resources to earn more foreign exchange or to save foreign exchange by improving the productivity of imports. If domestic savings is scarce, it is probably easier to find ways of using foreign exchange to substitute, raising the domestic savings ratio and the productivity of capital. See Thirwall (1983). When the shortage of domestic savings is the more important problem, the savings/investment gap will ex ante be the larger; when

foreign exchange is the constraint the ex ante export/import gap will be greater.

Two gap analysis is more persuasive to the extent that price adjustment, for example via the exchange rate is limited, and rigidities of the sort assumed in their models apply in reality to LDCs specially where there are limitations to the expansion of exports. In these countries investment depends in a relatively fixed way on imported inputs and the elasticity of substitution between domestic and imported inputs may be close to zero. If these assumptions are valid then the authorities which are committed to a particular growth target may adopt an "inward looking" trade policy, an approach which was adopted in Sri Lanka prior to 1977.

The structuralist approach to the finance of development is to encourage investment prior to saving. Investment is expected to generate savings, either through increases in output if resources are employed, or through income redistribution from groups with a low propensity to save to those with a high propensity. Structuralists also dispute that saving is necessary for investment and that investment is constrained by saving. The implication of this approach is that growth may be continued either by savings or foreign exchange and that foreign resources will usually be needed to supplement domestic savings if target growth rates are to be achieved. If a structuralist model

is to be successful in capturing the impact of monetary influences on the MTM, that model would need to have a whole spectrum of real and financial assets and the explicit relations between the production of new real capital goods and existing ones. See Brunner and Meltzer (1971).

The assumptions of the structuralist approach appear to us to be a little demanding in the context of Sri Lankan development after 1977. As explained earlier in this thesis, the government that came into power in 1977 followed more outward-looking open economic policies and therefore, the relevance of a structuralist model for the period of our research appears to be somewhat limited. Moreover, as we explained above, the objectives of this thesis suggest that a more monetarist-oriented approach would be appropriate.

4.3 Modifications for Sri Lanka 1977-1985

We introduced certain modifications into the SEACEN model for a number of reasons. First, it was necessary to examine whether the standard monetarist model used to analyse money's relationship with economic activity in SEACEN countries could be used to identify the important MTCs in Sri Lanka during the period 1977-1985. Secondly, it was intended to analyse whether the model is capable of explaining changes in the behaviour of major macro economic variables during this later period. Thirdly, we intend to

examine whether the results obtained from this type of a model can form the base for future monetary policy formulation.

As well as re-estimating the model completely with data for the later period, we made some important changes in the specification of particular equations, notably to disaggregate the identities for reserve money and total credit to establish the importance in the MTM of credit operations by both the government and the private sector. Secondly, we employ Two Stage Least Squares Principal Components (2SLS-PC) as an additional estimation method to the OLS parameter estimates used in the SEACEN study, and subject the model to a fuller range of validation techniques, both on an individual equation basis, and within the context of dynamic simulation.

In what follows we take each equation of the SEACEN model for Sri Lanka and discuss the results whilst highlighting the modifications introduced into our equations. Whenever there are important variables included in several equations, for example, the expected rate of inflation (π) we proceed with a general discussion which can then be assumed to apply to all other relevant equations which follow.

There are three demand for money equations in the monetary sector. The demand for currency equation has eight explanatory variables and all the key variables are

statistically significant. A key variable in the demand for money functions in the SEACEN study was the expected rate of inflation (π). This is the proxy for the substitution effect (SE) of the rate of return of real assets. Since π is highly significant in the SEACEN Sri Lanka money demand equations, private expenditure equation (despite a low t-ratio) and the aggregate price level, some justification for its exclusion in our model is required. π is calculated in the SEACEN study as follows:-

$$\pi_t - \pi_{t-1} = \gamma (\dot{p}_{t-1} - \pi_{t-1}) \quad 0 < \gamma < 1$$

where \dot{p} is the actual rate of inflation and the adjustment coefficient γ is determined outside the behavioural equation concerned. This is rather than specifying the expectations variable within the equation and eliminating it by substitution and transformation, with its place taken by a distributed lag on the actual variable. One presumes this would have raised problems of parameter identification where a partial adjustment process was also being assumed. In this specification price expectations are assumed to be adaptive i.e. the public are presumed to revise their expectations about inflation in proportion to the error they made in their expectations of price movements in the previous period. This hypothesis has been quite popular in applied econometrics.

We were unable to find a satisfactory statistical fit for this variable using both this process and other

methods of defining expectations. It is possible that this arises from the choice of a later time period, but we suspect that the original SEACEN formulation could be somewhat spurious given the complex nature of price expectations.

There are also a number of competing ways to model inflationary expectations and it is very difficult a priori to choose between them without specifying the relationships involved in detail. For example, an alternative to adaptive expectations is rational expectations theory in which inflationary expectations are based on an information set containing all relevant variables at a point in time. This allows for the identification from a reduced form relationship between inflation and the data that is available at the time about the formation of expected inflation. See for example Challen and Hagger (1983).

We began by testing the simple SEACEN formulation but did not find π to have the correct sign or to be significant during our time period. We then tested out the simplest form of the adaptive expectations hypothesis where π is set equal to the actual inflation rate lagged one year or separately 1, 2 and 3 quarters. We used both the previous period's inflation rate and the rate of change of the previous period's inflation in our equations. These were not satisfactory. We also calculated π as the sum of a three period moving average of past inflation rates. It did not prove to be significant.

In view of the ambiguity surrounding the definition and interpretation of this variable, we decided to proceed without it. We also felt that this variable would need to be defined more carefully and tested thoroughly within the broader framework of expectations theory before including it in the model, since it is likely to have an effect on the system as a whole and, if misspecified, could distort the other parameters. Clearly, more detailed research specific to this problem is required where a full specification of the model of inflation is being made. This is beyond the scope of our thesis.

Although in general the SEACEN study included interest rates in the demand for money functions, it omitted them in the demand for currency and demand deposit equations, perhaps due to the problem of multi-collinearity among key explanatory variables. The number of bank branches (NBO) is an important variable in the demand for currency equation in the SEACEN model but it was not significant in our equations, possibly as a result of the closure of most of the bank branches during the 1977-1985 period.

The equation for demand deposits in the SEACEN model and our model differ in the following respects. The SEACEN model used π and NBO as key variables. We

dropped both of them for reasons explained above and also because they were not significant in our model. Instead, we used the nominal interest rate (RST) which was significant. This variable is relevant to the post 1977 period as it captures the SE between interest bearing and non-interest bearing monetary assets triggered by the government's high interest rate policy.

Both real income and RST were significant in our equation for the demand for time and savings deposits unlike in the SEACEN model. We also introduced domestic credit (DC) as an explanatory variable for two reasons. First, there appears to be a close correlation between DC and the accrual of time and savings deposits in the post 1977 period as part of the increased money income was held in the form of time and savings deposits. Secondly, DC acts as a proxy for the "availability effects" associated with the credit rationing channel of the transmission process and, therefore, we wanted to compare the relative significance of this variable and the interest rate.

There are seven explanatory variables in the total reserves equation of the SEACEN model. A variable (Z) was introduced to represent a vector of cost push factors. The study did not clearly define what this variable is and the purpose of using it. If Z is used to reflect the opportunity cost of holding reserves, it may be the interest rate on competing reserve assets. The coefficient of this variable exceeds unity and is highly significant. In our

model we used the inter-bank call money market rate (ZXY) to represent the yield on competing reserve assets and the opportunity cost of holding reserves. ZXY also indicates the direction of short term lending rates in the money market.

This is particularly so as the Bank rate (the rate at which commercial banks borrow from the Central Bank) failed to perform the role of the Apex rate in the short term interest rate structure during this period. This is due to the introduction of quota restrictions on bank rate accommodation to commercial banks, the imposition of a graduated scale of penal rates during the first part of the period 1977-1985 and the excess liquidity of banks that prevailed during the second half of this period.

We next dealt with the issue as to whether the statutory reserves variable should be in ratio or level form. Since 1977, Sri Lanka used statutory reserve ratios as an effective instrument of monetary policy and revisions were introduced on several occasions. As shown below different reserve ratios were made applicable on various classes of deposits^{4/}.

Effective Date	Type of Liability	Revised Rate (in per cent)
1. 1960.08.26	Demand deposits	12%
	Time and Savings Deposits	5%
2. 1981.06.19	Demand deposits	14%
	Time and savings deposits	6%
3. 1983.12.02	Demand deposits	16%
	Time and savings deposits	8%
4. 1983.12.16	Total unused balances of overdrafts	16%
5. 1985.08.09	Demand deposits	18%
	Time and savings deposits (not exceeding 90 days)	12%
	Time deposits(excluding 90 days)	10%
	Savings deposits	10%
	Special deposits	10%
6. 1985.09.13	Time deposits (not exceeding 90 days)	14%

Source: Central Bank of Sri Lanka, Bulletin, December 1985.

In addition to these revisions, effective 14 November 1984, commercial banks were required to maintain special reserves under a reserve tranche system against increases in deposits over the level as of 14th November, 1984. Reserves in respect of each tranche were specified as follows:

i. Up to 3%	nil
ii. Over 3% and up to 6%	5% of increase
iii. 6% and up to 10%	10% of increase
iv. Over 10%	15% of increase

Since it was difficult to calculate a meaningful average of these ratios, we used required reserves in levels.

There are three identities used in the monetary sector of the SEACEN model. The two money supply identities (NMO and BMO) are clearly defined and specified. In terms of total liquidity NMO is not comprehensive as a considerable portion of the increased money income or wealth of the public is held in the form of time and savings deposits with the banking sector. Moreover, it does not help to analyse the SE between money and financial assets and between financial and real assets.

The reserve money identity (RM) is not clearly defined in the SEACEN model. RM is specified in terms of broader aggregates, i.e. $RM = NFA + NDA + OA$. (NDA includes claims on both private and government sectors) and it is not clear in the SEACEN study whether RM represents assets of the Central Bank or the entire banking system. Moreover, these broader aggregates do not reflect the differences in the behaviour of the private and government sectors. As a result, the impact of credit to government and the private sector cannot be fully assessed in a policy context.

Due to the ambiguous nature of the RM identity it is difficult to see how well the real and monetary sectors are linked through this identity. Strictly speaking RM only includes balance sheet items of the Central Bank. The overall balance of the BOP is equal to the change in net foreign assets of the banking system (including commercial banks). In the SEACEN model the BOP outcome is equal to

$NFA_t - NFA_{t-1}$ Even if we assume that the SEACEN model

refers to net foreign assets of the banking system there still remains a definitional problem about the link between RM and the BOP identity.

We disaggregated RM and assume that NFACB is a proxy for the change in net foreign assets of the banking sector. This is justified to the extent that more than 90 per cent of the NFA of the banking system is held by the Central Bank as commercial banks in Sri Lanka are not allowed to invest foreign exchange holdings at will. We also used the components of RM as policy variables in the simulation experiments.

In our model we use the BMO identity to link the monetary and real sectors which includes all components of RM. We also introduced two new identities: total deposits (TD) and domestic credit (DC) into our monetary sector model. TD enables us to examine the impact of exogenous changes in long term deposits (T1) via the reserves equation. The DC identity is specified as a component of the monetary survey. This allows us to examine the relevance of domestic credit in the MTM and reflects the lenders' reaction to policy changes. According to the availability effects, the driving force behind saving and borrowing decisions is not the interest rate but the availability of credit. As credit rationing (CR) has been an important monetary policy instrument the

use of this variable would help to capture the effects of selective credit policy.

The real sector of the SEACEN model contains four behavioural equations: the real expenditure of the private sector, the rate of inflation, the volume of imports and the volume of exports. The first two are specified so as to reflect the main assumptions of the model, that excess money spills over into the goods market and exerts pressure on both real expenditure and prices. We depart from the SEACEN version which splits the real expenditure into private and government sectors. Accordingly, government sector real expenditure is exogenous. We did not find this division useful because the structure of the SEACEN model is such that it does not show any response to changes in government expenditure in our case. Neither the components of government expenditure nor the financing part of it is represented through any of the variables in the system. This was also a consequence of data availability. We therefore, estimated total real expenditure including both private and government sectors together. As stated earlier, the private sector real expenditure function in the SEACEN model is explained by lagged real income, the difference between the real money supply (lagged) and money demand and lagged π . The underlying money demand function in this case is explained by real income and the expected rate of inflation.

The specification of the real expenditure function

in our model is different to that of the SEACEN model. π and interest rates (both real and nominal) were tested for in our study but were not significant. We also decided to use broad money as a more comprehensive proxy for total liquidity in the system rather than narrow money used in the SEACEN model. Both lagged real income and broad money variables are however, relevant in so far as they influence real expenditure and the aggregate price level.

The SEACEN model estimated both the rate of inflation and the price level (GDP deflator) and retained the latter for simulation purposes. Both equations however, displayed very poor statistical fit. Eight variables are used in the rate of inflation equation and none achieved a t greater than or equal to 2. Similarly, nine variables were used in the price level equation and except for the price level lagged one period $P(-1)$, all the other variables are insignificant.

In our price level equation, both demand and supply factors are taken into consideration along with lagged import prices to capture the impact of imported inflation. The latter variable is especially important as it represents the impact of trade liberalization and the depreciation of the Sri Lankan Rupee after 1977. It could be argued, on theoretical grounds, that the price equations should include a separate term to capture the effects of expected inflation on actual price changes, both directly through price mark-ups and indirectly through its effects

on money demand. Experiments including the expected rate of inflation variable however, did not prove satisfactory.

There are six explanatory variables in the volume of imports equation of the SEACEN model. Except for the lagged import variable all the others are insignificant. We modified this equation by including real income, lagged import prices (in real terms) and a lagged import credit variable. The latter is used to assess the impact of SCCs on imports.

There are seven explanatory variables in the SEACEN model designed to capture both supply and demand factors on real exports. Although it is designed to include a demand variables, no variable representing world demand was included. We modified the export equation by introducing an explicit demand variable: real income of OECD countries (GOECD), and the relative price of exports (XPFXPC) and obtained significant results. The latter reflects the competitiveness of Sri Lanka's exports in relation to exports of competing countries. We also included a lagged dependent variable to allow for a partial adjustment of actual to desired exports. The SEACEN export capacity variable was insignificant in our case.

The three identities in the real sector of the SEACEN model are for nominal income, real income and the BOP respectively. Our model specifies income in real terms and therefore drops the nominal income identity. Although

the SEACEN model treats government expenditure as an exogenous variable in the income identity it is not linked to the monetary survey through variables which account for financing of government expenditure. Both private and government credit are included in net domestic assets (NDA) and therefore, the model does not indicate the effects of changes in net credit to government (NCG) or to the private sector.

Most variables that account for financing government expenditure are outside the scope of the Monetary Survey. Contributions of the non-bank financial institutions can be obtained only from a full financial survey which is not available in Sri Lanka for the time period. Credit to government by the banking system represents only one part of the financing of government expenditure and, therefore, the impact on the monetary sector cannot be assessed without introducing an identity for financing of the government expenditure. In our model we used government expenditure as a part of total real expenditure which is endogenously determined. Unfortunately, as with the SEACEN model, it is not feasible to analyse the effects of government financing without the help of a financial survey.

The BOP identity used in the SEACEN study does not specify whether it refers to the current account balance, basic balance or the overall balance. We specified the BOP to reflect the overall balance and therefore linked it

explicitly to the net foreign assets of the banking sector via the net foreign assets of the Central Bank (NFACB). In Sri Lanka, the net external assets of the commercial banks consist only of foreign exchange working balances as they are not allowed to invest foreign exchange reserves. As a result, more than 90 per cent of net foreign assets are held by the Central Bank.

In the original Aghevli and Rodriguez model (1979) GAP is defined as the difference between actual and potential output. GAP is assumed to respond positively to the level of excess demand in the goods market which is generated by the excess supply of money. In addition, for any given excess supply of money, the rate of adjustment of actual output towards its potential level is assumed to depend on the excess capacity present in the economy. This assumption is in line with the monetarist formulation.

In the SEACEN model, the output GAP is defined as the log of the ratio of potential over actual output. They assumed over the long run that changes in the level and the composition of demand affect the growth of output. GAP is the self correcting mechanism that adjusts the actual growth rate of output towards the potential (trend) rate. The SEACEN study however, did not use GAP as an explanatory variable in any of the equations or as an identity. We found it to be insignificant in the imports and price level equations.

As a third identity, therefore, we used GAP measured as the ratio of actual income to potential income as a proxy for capacity. Potential income is calculated by fitting a trend line to the actual income series. Any changes in real income would therefore, be reflected in changes in the GAP and may capture some of the supply side effects on the MTM. This definition of GAP is however, still too simple and a more detailed treatment of this supply variable would be needed in a future study.

4.4 Model Specification

Following Aghevli and Rodriguez (1979) and SEACEN (1981) we are dealing with a goods-money economy in which excess demand for goods results in higher output, higher prices, or a deterioration in the trade balance. We are concerned essentially with developments in the short run when markets are in disequilibrium and adjustments depend on the excess of money, the openness of the economy, and the existing level of excess capacity, although we shall also refer to some longer term implications.

The model can be viewed initially as comparing two self-contained and mutually exclusive sectors which are subsequently combined in a simulation framework. A financial sector deals with the money supply process and the real sector assumes the money supply to be pre-

determined and relates it to output, the price level and the BOP. The model is summarized in 4.5 and the variables are defined.

4.4.1. The Monetary Sector

The monetary sector contains 4 behavioural equations and 4 identities. The money supply in this model (6) is derived in a familiar fashion from the stock of RM and the components of the mm. We have chosen to use BMO rather than narrow money and to convert it into real terms via the Colombo Consumers' Price Index (CP). We also disaggregated RM into its constituent parts in (7) to facilitate exposition at this stage. It is not necessary for model simulation.

More specifically, BMO is defined as the sum of currency circulating outside the banks, demand deposits and time and savings deposits held by the private sector with the commercial banks.

$$BMO = CU + D + T$$

The MB consists of all sight liabilities of the Central Bank (total currency issue plus reserves of the commercial banks plus deposits of other institutions held with the Central Bank).

$$RM = CI + R + RS$$

Hence, the broad money multiplier in (6) is

$$\frac{CU + D + T}{CI + R + RS}$$

and BMO can be re-written as

$$BMO = \frac{CU + D + T}{CI + R + RS} \cdot RM$$

With RM viewed as the assets of the Central Bank (CB) disaggregated in (7) into its various components, including net foreign assets of the CB, net credit to government by the CB and gross credit to the commercial banks by the CB.

The demand for money by the private sector is estimated by 3 behavioural equations (1), (2), (3) referring respectively to currency, demand deposits and time and savings deposits. Equation (4) specifies the demand for reserves by the commercial banks.

(5) and (8) are the other identities of the monetary sector which are included primarily for purposes of simulation. The identity for total deposits TD, which is an explanatory variable in the reserve equation (4) allows us to manipulate the long term deposits of the government and other institutions. T1 and the direct credit identity (8) enables us to analyse the "availability effects" of monetary policy through the demand for time and savings deposits equation (3). In particular, DC is directly related to BMO and the net domestic assets of the banking system.

4.4.2. The Real Sector

The real sector contains 4 behavioural equations and 3 identities. The behavioural equations determine total real domestic spending or absorption, the aggregate price level, and the real volume of imports and exports. The identities define real gross domestic product (income), the BOP and an index of excess demand/capacity. We shall examine each in turn.

Total real expenditure (absorption) consists of both private and government spending on domestic and imported goods and is related to both the level of real income and the excess of money over demand:

$$(1) \quad \text{PAG}/P = f [YQ, (M/P - M_d/P)]$$

This specification reflects the view that in the real sector the money supply is exogenous and the excess of actual money over desired $M/P - M_d/P$ spills over into the goods market and will manifest itself in increasing expenditure on domestic and imported goods by both the private and government sectors. M_d/P in turn consists of the sum of currency CU/CP , demand deposits D/CP , and time and savings deposits T/CP , corresponding to our definition of real broad money BMO/CP . These components have already been explained in the monetary sector in equations (1), (2), and (3) by real income YQ and other variables. BMO/CP

plays an important role here because it acts as the mechanism by which monetary impulses are transmitted to the real sector.

Equation (10) is derived from an analysis of the ^{5/}inflationary process in an open goods-money economy. Inflationary and deflationary gaps are seen to resolve themselves in the traded goods sector through an increase in net imports, and in the non-traded goods sector by an excess of actual over desired money spilling over into higher prices. This spill over effect arises in the short run because sufficient quantity adjustments are not possible in such a short period. In the longer run, however, changes in the level and composition of demand affect the growth of output. The combined result of these changes provides a measure of demand pressure on the GDP deflator P , which is supplemented by cost push factors including changes in import prices.

Again, (5) is transformed into an estimating equation by taking logs, adding lags to the explanatory variables for non-instantaneous adjustment, and testing for partial adjustment via the lagged dependent variable. M/P was replaced by BMO/CP and we chose to estimate the equation in level rather than in change form to facilitate simulation.

Since it is not possible for Sri Lanka to separate out domestic spending on home goods from spending on

imports, real imports (11) are estimated as a behavioural equation.^{6/} As Sri Lanka is small country in international trade, imports are demand determined and import prices are taken as exogenous, in line with standard practice.

Our final behavioural equation in the real sector is an aggregate export function. It is often very difficult in developing countries such as Sri Lanka to distinguish between demand and supply factors affecting exports, since the data is consistent with both the volume demanded and the volume supplied.^{7/} Hence an aggregate function is specified containing both supply and demand factors.

To complete the specification of the real sector we postulated 3 identities. (13) defines GDP in real terms as the sum of total real expenditure and the difference between the volume of real exports and imports. Lack of suitable data precluded us from distinguishing between government and private spending and simulating exogenous changes in the former.

(14) deliberately defines the BOP as the overall balance rather than as the basic balance or current account. This is so that we can discuss the links between the BOP and the RM identity (7) in the monetary sector^{8/} through changes in net foreign assets (NFA). In other words, we can simplify (7) into NFA, NDA and other influences of the banking system (OAB).

Finally, the GAP identity (15) is expressed as the ratio of actual to potential income (calculated by fitting a linear trend line to actual income). This represents a simple measure of excess demand or low capacity to capture supply effects in the model^{9/}.

In 4.5 we present the model in its full form. The prefix Ln indicates that the variable concerned is expressed as a natural logarithm, while the suffix (-1), (-2) etc. signifies the length of the lag attached to the variable, measured in quarters.

4.5 The Estimating Model

Monetary Sector

(a) Behavioural equations

$$[1] \quad \text{Ln (CU/CP)} = a_0 + a_1 \text{Ln YQ} + a_2 \text{Ln (CU/CP)}(-1) \\ + a_3 \text{Ln RST} + a_4 D_2$$

$$[2] \quad \text{Ln (D/CP)} = b_0 + b_1 \text{Ln YQ}(-4) + b_2 \text{Ln (D/CP)}(-4) \\ + b_3 \text{Ln RST}$$

$$[3] \quad \text{Ln (T/CP)} = c_0 + c_1 \text{Ln YQ}(-1) + c_2 \text{Ln RST} \\ + c_3 \text{Ln DC} + c_4 D_1$$

$$[4] \quad \text{Ln R} = d_0 + d_1 \text{Ln ZXY} + d_2 \text{Ln TD} + d_3 \text{Ln RR}$$

(b) Identities

$$[5] \quad \text{TD} = D + T + T_1$$

$$[6] \quad \text{BMO/CP} = \frac{\text{CU/CP} + \text{D/CP} + \text{T/CP}}{\text{CI/CP} + \text{R/CP} + \text{RS/CP}} \cdot \text{RM}$$

$$[7] \quad \text{RM} = \text{NFACB/CP} + \text{NCG/CP} + \text{GCB/CP} + \text{DOI/CP} + \text{OINCB/CP}$$

$$[8] \quad \text{DC} = \text{BMO/CP} \times \text{CP} - \text{NFA} - \text{OAB}$$

Real Sector

(a) Behavioural equations

$$[9] \quad \text{Ln (PAG/P)} = e_0 + e_1 \text{Ln YQ}(-3) + e_2 \text{Ln (BMO/CP)}(-1) + e_3 \text{D4}$$

$$[10] \quad \text{Ln P} = f_0 + f_1 \text{Ln MP}(-2) + f_2 \text{Ln (BMO/CP)}(-2) + f_3 \text{D1} + f_4 \text{D4}$$

$$[11] \quad \text{Ln MQ} = g_0 + g_1 \text{Ln YQ}(-2) + g_2 \text{Ln MP}(-4) + g_3 \text{Ln IC}(-1)$$

$$[12] \quad \text{Ln XQ} = h_0 + h_1 \text{Ln GOECD}(-4) + h_2 \text{Ln XPFXPC}(-4) + h_3 \text{Ln XQ}(-1)$$

(b) Identities

$$[13] \quad \text{YQ} = \text{PAG/P} + \text{XQ} - \text{MQ}$$

$$[14] \quad \text{BOP} = \text{XQ.XP} - \text{MQ.MP} + \text{CAP}$$

$$[15] \quad \text{GAP} = \text{YQ/YQT}$$

Endogenous variables

CU Demand for currency

D Demand for demand deposits

T Demand for time and savings deposits

CU/CP	Real demand for currency in circulation
D/CP	Real demand for demand deposits
T/CP	Real demand for time and savings deposits
R	Total reserves of the commercial banks
TD	Total deposits
BMO	Broad money
RM	Reserve money (monetary base)
DC	Domestic credit
PAG	Total expenditure (private and government)
P	Aggregate price level (GDP deflator)
PAP/P	Total real expenditure
MQ	Real volume of imports of goods and services (1980=100)
XQ	Real volume of exports of goods and services (1980=100)
YQ	Real gross domestic product (1980=100)
BOP	Overall balance of payments
GAP	Index of excess demand/capacity

Exogenous variables

CP	Colombo consumer's price index (1980=100)
RST	Average deposit rate on 12 month time and savings deposits of commercial banks
Di	Seasonal dummies (quarter $i=1, \dots, 4$)
ZXY	Lending rate in the interbank call money market
RR	Statutory reserve requirements (level)
T1	Long term deposits of the government and government sponsored institutions

CI	Total currency issue (sight liabilities of the Central Bank
RS	Deposits of other institutions held with the Central Bank
NFACB	Net foreign assets of the Central Bank
NCG	Net credit to government by the Central Bank
GCB	Gross credit to the commercial banks by the Central Bank
DOI	Gross credit to the other development institutions by the Central Bank
OINCB	Other items (net) of the Central Bank
NFA	Net foreign assets of the banking system
OAB	Other assets (net) of the banking system
MP	Real import price index in home currency (1980=100)
IC	Bank credit for imports
GOECD	Real gross domestic product of OECD countries (1980 =100)
XPFXPC	Real foreign currency price of exports as a ratio of the export prices of competing countries (1980=100)
XP	Real export price index (1980=100)
CAP	Capital account of the balance of payments
YQT	Potential output derived from a linear trend line fitted to YQ

A flow diagram of the model and abbreviations used

are presented in Appendix 4.2 and 4.3. This displays the interactions between the monetary and the real sectors and the channels through which these interactions are established. It also indicates the pivotal role of broad money in linking the monetary and the real sector.

4.6. Data Problems

The model summarized in 4.5 was estimated using quarterly data between 1977 quarter 1 and 1985 quarter IV. The period thus covers 9 years and there are 36 observations. Real sector data covering variables such as real GDP (YQ), the GDP deflator (P), and total real expenditure (PAG/P) is available only on an annual basis and represents flows during a year. Hence, a smoothing technique was necessary to convert the data to a quarterly basis. For this purpose we used the Otani Reichel Smoothing Technique^{10/} (1973). This technique is elaborated on Appendix 4.4. The GDP deflator is obtained by dividing GDP in current prices by GDP in constant 1980 prices. Trade data is taken from the BOP and is consistent with the National Accounts series. Real income in OECD countries (GOECD) is converted from Quarterly Reports of OECD countries.

Data for the monetary sector, end quarter (actual outstanding), is available for the entire period and is collected directly from Monthly Bulletins, Annual Reports, and Annual Reviews of the Central Bank of Sri Lanka. Monetary sector data are deflated by the Colombo Consumers'

price index (CP) based on 1980=100.

Generally speaking the data available is good by developing country standards, although the generation of quarterly data is likely to introduce some errors in variables and may lead to bias and inconsistency in the parameter estimates. The sample size is satisfactory.

4.7 Estimation Methods.

The model taken as a whole represents a simultaneous system of stochastic non-linear equations, being linear in the parameters but non-linear in the variables^{11/}. It is dynamic because it contains lagged predetermined variables and simultaneous because endogenous variables appear on both the left and right hand sides of the equations and identities.

More specifically, simultaneity is present because equation [3] cannot be solved without the simultaneous determination of DC in [8]; [4] without solving for TD in [5]; and [6] without determining DC in [8]. It would appear at first sight that [1] also requires the simultaneous solution of [13] because YQ appears in both, but the bloc recursive nature of the model as a whole ensures that YQ from the real sector bloc permits the determination of [1] in the monetary sector. In sum, therefore, the model comprises 9 recursive and 5

In the first instance all equations were estimated by ordinary least squares (OLS) using Time Series Processor (TSP) version 3.5 at the University of Bradford. These are the estimates discussed in detail in 4.8 and are used in the simulation control run. Although it is well known that OLS produces biased and inconsistent estimates in simultaneous systems, it has become conventional practice in macro modelling to carry out preliminary work on a model using this method. For a review of different estimators used in the context of macro modelling, see Challen and Hagger (1983). In general, the appeal of OLS stems from the fact that its statistical properties are relatively well known compared to other estimation techniques, especially in small samples, and because it offers a computationally cheap way of testing a range of hypotheses. In addition, more complex techniques such as full information estimators, tend to be more sensitive to specification errors. OLS has the advantage of 'quarantining' the effects of misspecification until the properties of the model are better understood and is relatively easy to interpret.

We did, however, re-estimate the model using a variation of Two Stage Least Squares (2SLS) to try to improve consistency and to compare the results, particularly in a simulation context. Since our model contains a large number of predetermined variables (21 in

the equations and 36 in the model as a whole) in relation to the sample size, we used principal components to reduce the number of predetermined variables to a more fundamental set of instruments for use in 2SLS. The instruments were selected on the basis of explaining at least 95 per cent of the variation in the larger set of variables, and a correction for first order autocorrelation was carried out where appropriate using the Fair (1970) method of instrumental variable estimation available in TSP. The results of the Two Stage Least Squares Principal Components (2SLSPC) are given in Appendix 4.5 and are discussed more fully in the context of simulation in the next chapter.

Our basic estimation procedure was to start from the a priori specification described above using a log functional form unless unsatisfactory, and to experiment with different sets of explanatory variables and lag structures. Although our resources fell short of a rigorous testing procedure of the type embodied in a package such as Hendry's (1985) PC GIVE, we did attempt to follow some 'rules of good conduct'.^{13/} Initial selection of an estimated equation was based upon sensible parameter estimates in terms of size and sign and an acceptable statistical fit using conventional statistics. Where an equation failed the Durbin Watson or Durbin h test for autocorrelation, a correction was made using the Beach-^{14/} Mckinnon method in TSP. All equations were also checked for multicollinearity via the Farrar-Glauber tests although

no explicit correction was introduced for this problem. Where there was any doubt about the choice of equation, particularly if this impinged heavily upon the transmission mechanism of monetary policy, alternatives were retained for comparison in simulation.

4.8 Results

The results are shown for each equation in turn, together with a number of relevant statistics. \bar{R}^2 is the multiple correlation coefficient adjusted for degrees of freedom. F is the F distribution statistic. SE is the standard error of the regression. DW is the Durbin Watson statistic for first order autocorrelation. h is the Durbin h test for first order autocorrelation in the presence of a lagged dependent variable. RHO is the first order autoregressive parameter, and n refers to the sample size. Where the equation is corrected for autocorrelation (all equations except [1] and [2]), RHO is presented together with the original unadjusted DW or h as appropriate; but where autocorrelation is not present, DW and h refer to the equation as presented. t-ratios are shown in parentheses beneath each estimated coefficient. Unless indicated by a *, all coefficients are significant at the 5 per cent level or better.

Demand for real currency

$$[1] \text{ Ln (CU/CP) } = -.778 + .379 \text{ Ln YQ } + .760 \text{ Ln (CU/CP)}(-1) \\ (-1.05^*) \quad (6.39) \quad (9.25)$$

$$-.308 \text{ Ln RST } + .042 \text{ D2 } \\ (-6.05) \quad (2.28)$$

$$\bar{R}^2 = .83 \quad F = 41.47 \quad SE = .044 \quad h = -1.25 \quad n = 35 \quad D.W = 2.3$$

Although there is evidence of multicollinearity between all the explanatory variables except the seasonal dummy, the relevant elasticities conform to expectations. The short-run income elasticity of demand for currency of .379 and long-run value of 1.58 are similar to those found by the SEACEN Sri Lanka study, but are generally higher than in the other country studies. The transactions demand for currency is thus relatively inelastic in the short run but exceeds unity in the longer run when a partial adjustment process is taken into account. In contrast to the SEACEN Sri Lanka study, we also obtained significant negative elasticities for currency demand with respect to nominal interest rates on time and savings deposits, suggesting some substitution between financial assets over this period. The long-run elasticity is - 1.28. The π used by SEACEN (1981) to represent the rate of return as fixed assets was not significant. The dummy variable used to capture the seasonal effects in the second quarter was

significant but the one used to represent the effects of uncertainty was not significant. However, in view of the multicollinearity between the key independent variables, this result should be treated with caution.

Demand for real demand deposits

$$\begin{aligned}
 [2] \quad \ln (D/CP) = & 3.135 + .151 \ln YQ(-4) + .541 \ln (D/CP)(-4) \\
 & (2.89) \quad (1.95^*) \quad (3.38) \\
 & -.248 \ln RST \\
 & (-2.65)
 \end{aligned}$$

$$\bar{R}^2 = .45 \quad F = 9.43 \quad SE = .061 \quad h = .84 \quad n = 32 \quad D.W = 1.86$$

The overall fit of this equation is not entirely satisfactory, with the income variable significant only at the 10 per cent probability level. However, we were unable to improve the fit of this equation by changes in specification. However, there was no strong evidence of multicollinearity. The income elasticities of .151 in the short-run and .33 in the long-run are significantly lower than those found for Sri Lanka by SEACEN (.61 and 1.87), but are closer to the SEACEN averages of .25 and .75 excluding the relatively high values for Sri Lanka. The interest elasticities of -.248 and -.54 are again higher than those found for comparable estimates in the SEACEN study dealing with the earlier time period. The SEACEN Sri Lanka study found no significant interest rate effect on portfolio adjustment.

Demand for Real time and savings deposits.

$$\begin{aligned} [3] \text{ Ln } (T/CP) = & 1.015 + .267 \text{ Ln } YQ(-1) + .231 \text{ Ln } RST \\ & (1.10^*) \quad (3.00) \quad (2.72) \\ & +.496 \text{ Ln } DC \quad -.123 \text{ D1} \\ & (7.37) \quad (-6.05) \end{aligned}$$

$$\bar{R}^2 = .98 \quad F = 568.79 \quad SE = .063 \quad DW = .42 \quad RHO = .798 \quad n = 35$$

Again, the notable feature of this equation is the positive significant interest elasticity. Although the sign was correct in the SEACEN Sri Lanka study, it was insignificant. The arithmetic mean for the SEACEN countries as a whole is also much smaller at .028. This would support the view that Sri Lankans became more interest conscious during this later period. The elasticity of .26 with respect to income lagged one period is also higher than the SEACEN countries as a whole, although it was not meaningful to compute a mean figure for the latter. Although an income variable was not included in the Sri Lanka study, it is possible that their use of the number of bank offices (elasticity = .065) picks up some of the influence of our income variable. Domestic Credit (DC) appears to be highly significant in the accrual of financial savings and it may be treated as a proxy for income. The seasonal dummy variable was included to capture the effect of portfolio adjustment in favour of consumption expenditure during festive seasons. We attempted to highlight the

importance of financial innovation (FI) in the demand for time and savings deposits using a dummy variable for the introduction of new instruments. However, it was not statistically significant. Multicollinearity was clearly present in this equation as a whole. We used the Farrar-Glauber X^2 and F tests (especially with respect to DC), but this was not reflected in the partial correlation coefficients between the explanatory variables. The only significant t statistic was between lagged income and the seasonal dummy, and this was not of a high order of magnitude.

Total reserves.

$$[4] \quad \ln R = -1.161 \quad -.183 \ln ZXY + .577 \ln TD + .466 \ln RR$$

$$\quad \quad \quad (-1.79^*) \quad (-2.22) \quad \quad (3.29) \quad \quad (3.04)$$

$$\bar{R}^2 = .97 \quad F = 360.99 \quad SE = .075 \quad DW = .88 \quad RHO = .55 \quad n = 36$$

An interesting feature of this equation is the significant negative relationship between reserves and the inter-bank call market loan rate ZXY. This is designed to test the impact of short-term lending rates representing the opportunity cost of holding higher reserves. In the Sri Lanka SEACEN study they used a measure of the price which the banks must pay to borrow from the Central Bank. This was insignificant in our study, probably because the Central Bank introduced quotas on borrowed reserves in the first part of our period, and there was excess liquidity in the commercial banks during the second. TD and RR are, as expected important determinants of reserve behaviour, as in the SEACEN countries in general. Required reserves, in

particular, was one of the most effective monetary instruments available to the Central Bank over this period. Multicollinearity is strong in this equation as a whole and is significant between ZXY and TD and RR and TD, but in neither case is the Farrar-Glauber t-statistic especially high.

Total real expenditure

$$[5] \text{ Ln (PAG/P) } = 1.609 + .322 \text{ Ln YQ}(-3)$$

$$(1.57*) \quad (3.06)$$

$$+ .523 \text{ Ln (BMO/CP)}(-1) + .090 \text{ D4}$$

$$(5.29) \quad (3.09)$$

$$\bar{R}^2 = .97 \quad F = 298.81 \quad SE = .078 \quad DW = 1.37 \quad RHO = .33 \quad n = 33$$

Since we define PAG/P to include both private and government expenditure, we are unable to compare our estimates directly with the SEACEN study. The only comparable figure is that for the log of real income lagged one period (.636) from Wijesinghe (1986). Both the lagged income and lagged real money estimates are, however, as expected, with the latter confirming the spillover effect through which monetary impulses are transmitted to the real sector. We tried to use the interest rate variable in this equation but it was not significant. Although there is some multicollinearity present in this equation, only the relationship between the lagged income variable and the dummy is significant.

Aggregate price level

$$\begin{aligned} [10] \text{ Ln P} = & -1.922 + .661 \text{ Ln MP}(-2) + .385 \text{ Ln (BMO/CP)}(-2) \\ & (-3.04) \quad (5.46) \quad (6.09) \\ & + .049 \text{ D1} - .054 \text{ D4} \\ & (5.93) \quad (-6.65) \end{aligned}$$

$$\bar{R}^2 = .98 \quad F = 393.39 \quad SE = .028 \quad DW = .18 \quad RHO = .94 \quad n = 34$$

In contrast to the rather poor fits obtained for the inflation and aggregate price level equations in the SEACEN Sri Lanka study, we were able to achieve an acceptable result. Of particular interest for a relatively open economy such as Sri Lanka is the coefficient on the import price variable, which captures the impact of a rise in import prices or a depreciation of the nominal exchange rate. The impact of imported inflation is particularly important with liberalisation and depreciation of the rupee after 1977. The broad money coefficient also supports the spillover effect of an increase in real money on the price level. Multicollinearity was detected in the equation but was only significant for the relationship between lagged import prices and lagged broad money and with a relatively low t-statistic.

Volume of real imports.

$$\begin{aligned} [11] \text{ Ln MQ} = & 5.159 + .224 \text{ Ln YQ}(-2) - .408 \text{ Ln MP}(-4) \\ & (4.25) \quad (2.32) \quad (-2.94) \\ & + .449 \text{ Ln IC}(-1) \\ & (7.02) \end{aligned}$$

$$\bar{R}^2 = .99 \quad F = 888.03 \quad SE = .057 \quad DW = 1.04 \quad RHO = .47 \quad n = 32$$

A key feature of this equation is the relatively low elasticity of import demand with respect to real income lagged two periods of .224. This compares with a mean short-run value of .45 and long-run value of 1.45 for the SEACEN countries as a whole. The SEACEN Sri Lanka equation is particularly poor overall here, with only the lagged dependent variable significant. It is possible that the low income elasticity reflects the success of policy controls on imports over both periods, especially in view of the highly significant coefficient for lagged import credit over our period when import credit for priority imports was seen as an effective instrument of monetary policy. From another point of view it may also be possible that the import credit variable overshadowed the effects of income on imports. Current income may not reflect the import propensity as imports were restricted during the previous period. The relatively inelastic response of imports to import prices is as one would expect of an economy geared up to essential imports of consumer goods and dependence on imports of intermediate and capital goods. This estimate also compares favourably with both the general SEACEN findings and the Sri Lankan study of Wijesinghe (1986). Multicollinearity was found in this equation but it is significant only for the relationship between lagged import prices and lagged import credit, with

a relatively low t-statistic.

Volume of real exports.

$$\begin{aligned}
 [12] \quad \ln XQ &= -2.222 + 1.281 \ln GOECD(-4) - .248 \ln XPFXPC(-4) \\
 &\quad (-1.44^*) \quad (4.87) \quad (-4.39) \\
 &\quad + .333 \ln XQ(-1) \\
 &\quad (4.30)
 \end{aligned}$$

$$\bar{R}^2 = .99 \quad F = 2669.28 \quad SE = .049 \quad h = 1.85 \quad RHO = -.38 \quad n = 32$$

Both the SEACEN Sri Lanka study and Wijesinghe's (1986) later work on Sri Lanka failed to achieve a significant coefficient for a variable representing world demand. Our elasticities with respect to real income of OECD countries (GOECD) lagged four periods of 1.28 and long-run value of 1.92, however, are not surprising in view of the openness of the Sri Lankan economy, and are similar to those estimated for Malaysia (1.26) Indonesia, Singapore (3.12) and Thailand (0.88) within the SEACEN study. The inelastic price coefficient of -.248 in the short-run and - .37 in the long-run are also similar to, but a little smaller than those achieved by Wijesinghe and the SEACEN countries in general. Surprisingly, the SEACEN Sri Lanka study did not obtain a significant estimate for this key parameter. Overall, multicollinearity was present in this equation and was significant between the lagged world demand variable and the lagged dependent variable.

A relative price variable reflecting Sri Lanka's

export prices vis-a-vis the export prices of her competitors is introduced through XPFXPC. This variable is also linked to the exchange rate as the foreign price of exports is influenced by the changes in the exchange rate. The sensitivity of exports to XPFXPC is reflected in the coefficient (short run elasticity) of - 0.248.

On the whole, the results conform to prior expectations and the equations provide a good statistical fit. As far as the difference between the OLS and 2SLSPC estimates are concerned (see Appendix 4.5), The only notable difference observed in these estimates is the change in the interest rate variable in equation [3']. The positive interest rate in the OLS estimates changes to negative in 2SLSPC. A comparison between these two estimators in a simulation context is carried out in chapter 5.

FOOT NOTES

1. See, for example, Arestis and Hadjimatheou (1982).
2. For a review of these developments, see Hallwood and Macdonald (1986).
3. In some SEACEN countries this was estimated as a demand for excess reserves. See SEACEN (1981, p.30).
4. Due to the introduction of a wide array of reserve ratios on different classes of assets it was not feasible to use an average of reserve ratios. Hence, RR was defined in level terms.
5. In the absence of suitable data on domestic spending on home goods, we were unable to distinguish between spending on domestic and foreign goods. Imports were, therefore, determined as a behavioural equation and an overall price equation was estimated. For a discussion of the methodology involved, see SEACEN (1981).
6. For a review of developments in the modelling of the external sector, see Arestis and Hadjimatheou (1982). The problems associated with Sri Lanka in particular are discussed in Wijesinghe (1983, 1986).
7. See Arestis and Hadjimatheou (1982).
8. Strictly speaking, NFACB in (7) only refers to the net foreign assets of the Central Bank. However, since other foreign assets are quite small, this is not especially misleading.
9. This variable is discussed in some detail in SEACEN (1981). Note that in our case we have inverted this index so that it measures excess demand rather than excess capacity.
10. This technique is assessed in SEACEN (1981).
11. The general properties of simultaneous equation systems are explained in Pindyck and Rubinfeld (1986) and Challen and Hagger (1983).
12. Note that identity (7) is redundant in the actual solution of the model. It is retained in the specification of the model in order to be able to disaggregate RM for purposes of exposition.

13. See, for example, the 'rules' suggested by Challen and Hagger (1983).
14. A 5 % significance level was used for both tests. An equation was deemed to have failed the Durbin-Watson test if it failed on the upper limit specified. This is in line with the more cautious amended version of the DW test. See Koutsoyiannis (1977).

Appendix 4.1

Results for the Sri Lanka SEACEN model

1. Demand for real currency

$$\begin{aligned} \ln C/cp &= -1.82473 + .48811 \ln YQ - 10.1584 \pi + .07751 \ln NBO \\ &\quad (-1.73753) \quad (2.5695) \quad (3.85717) \quad (2.46559) \\ &+ .64612 \ln C/cp(-1) + .04196 D1 + .03562 D2 - .01746 D3 \\ &\quad (6.87118) \quad (2.1152) \quad (1.64849) \quad (.91512) \\ \bar{R}^2 &= .97188 \quad \quad \quad D.W. = 1.93 \\ \bar{R}^2 &= .96458 \quad \quad \quad RHO1 = .0633 \end{aligned}$$

2. Demand for real demand deposits

$$\begin{aligned} \ln D/cp &= -2.99964 + .61230 \ln YQ - 8.95903 \pi + .06597 \ln NBO \\ &\quad (-2.45464) \quad (2.87267) \quad (-3.62132) \quad (2.15195) \\ &+ .67246 \ln D/cp(-1) + .02879 D1 + .000040374 D2 \\ &\quad (7.64295) \quad (0.76850) \quad (.00145) \\ &+ .00207 D3 \\ &\quad (.05606) \\ \bar{R}^2 &= .97938 \quad \quad \quad D.W. = 1.94 \\ \bar{R}^2 &= .97404 \quad \quad \quad RHO1 = -.3854 \end{aligned}$$

3. Demand for time and savings deposits in real terms

$$\begin{aligned} \ln T/cp &= .51351 + .01894 r_{st} - 5.63759 \pi \\ &\quad (.87461) \quad (1.46052) \quad (-2.58848) \\ &+ .06531 \ln NBO + .87549 \ln T/cp(-1) \\ &\quad (2.27164) \quad (10.8512) \\ &- .02298 D1 - .01650 D2 - .02823 D3 \\ &\quad (-.74276) \quad (-.6374) \quad (-.94115) \\ \bar{R}^2 &= .99079 \quad \quad \quad D.W. = 2.02 \\ \bar{R}^2 &= .9884 \quad \quad \quad RHO1 = -.2246 \end{aligned}$$

4. Total reserves

$$\begin{aligned}
 R = & -74.4474 + .10009 \text{ NBO} + 17.3774r^c + .07229 (D + T) \\
 & (-1.60728) \quad (2.15758) \quad (2.26937) \quad (14.4285) \\
 & + 1.03359Z - 11.5568D1 - 9.18421D2 - 20.1448D3 \\
 & (14.2641) \quad (.78283) \quad (.64003) \quad (1.41413)
 \end{aligned}$$

5. Private sector real expenditure

$$\begin{aligned}
 \text{Ln PA/P} = & 2.89461 + .30777 \text{ LnYQ}(-1) + .30477 \text{ Ln NMO/cp}(-1) \\
 & (3.75393) \quad (2.2900) \quad (6.07155) \\
 & + 12.2465 \pi(-1) + .0127D1 + .00746D2 + .01652D3 \\
 & (6.2990) \quad (1.33004) \quad (.61802) \quad (1.38182) \\
 \bar{R}^2 = & .92854 \quad \text{D.W.} = 1.95 \\
 \bar{R}^2 = & .91323 \quad \text{RHO1} = .7319 \\
 & \quad \text{RHO2} = -.2672
 \end{aligned}$$

6. Rate of price inflation

$$\begin{aligned}
 \Delta \text{LnP} = & .27859 + .05732 \text{ LnNMO/cp}(-1) - .08745 \text{ LnYQ}(-1) \\
 & (.36165) \quad (.96216) \quad (-.60138) \\
 & + .88565 \pi(-1) + .03459 \Delta \text{LnMP} + .02996DF + .01404D1 \\
 & (.49682) \quad (1.13299) \quad (1.63656) \quad (1.27684) \\
 & + .0041D2 + .00587D3 \\
 & (.33616) \quad (.43881) \\
 \bar{R}^2 = & .31543 \quad \text{D.W.} = 2.00 \\
 \bar{R}^2 = & .1048 \quad \text{RHO1} = .2127
 \end{aligned}$$

$$\begin{aligned}
 \text{LnP} = & -.72931 + .13902 \text{ LnNMO/cp}(-1) - .04141 \text{ LnYQ}(-1) \\
 & (-.72867) \quad (1.72614) \quad (-.28633) \\
 & + 3.32903 \pi(-1) + .01678 \text{ LnMP} + .02747DF + .01491D1 \\
 & (1.38760) \quad (.52198) \quad (1.53703) \quad (1.37518) \\
 & + .00348D2 + .00472D3 + .90512 \text{ LnP}(-1) \\
 & (.29084) \quad (.35876) \quad (14.2490) \\
 \bar{R}^2 = & .99432 \quad \text{D.W.} = 2.02 \\
 \bar{R}^2 = & .99227 \quad \text{RHO1} = .1936
 \end{aligned}$$

7. Volume of imports

$$\begin{aligned} \text{LnMQ} = & - 2.63167 + .41007 \text{ LnYQ} - .05355 \text{ LnMP/p} + .89123 \text{ LnMQ}(-1) \\ & (-2.0659) \quad (.95069) \quad (-.77767) \quad (9.29204) \\ & + .01791\text{D1} + .02178\text{D2} - .01184\text{D3} \\ & (.68900) \quad (.71554) \quad - (-.4653) \end{aligned}$$

$$\bar{R}^2 = .93582$$

$$\text{D.W.} = 2.09$$

$$\bar{R}^2 = .92207$$

$$\text{RHO1} = .3414$$

8. Volume of exports

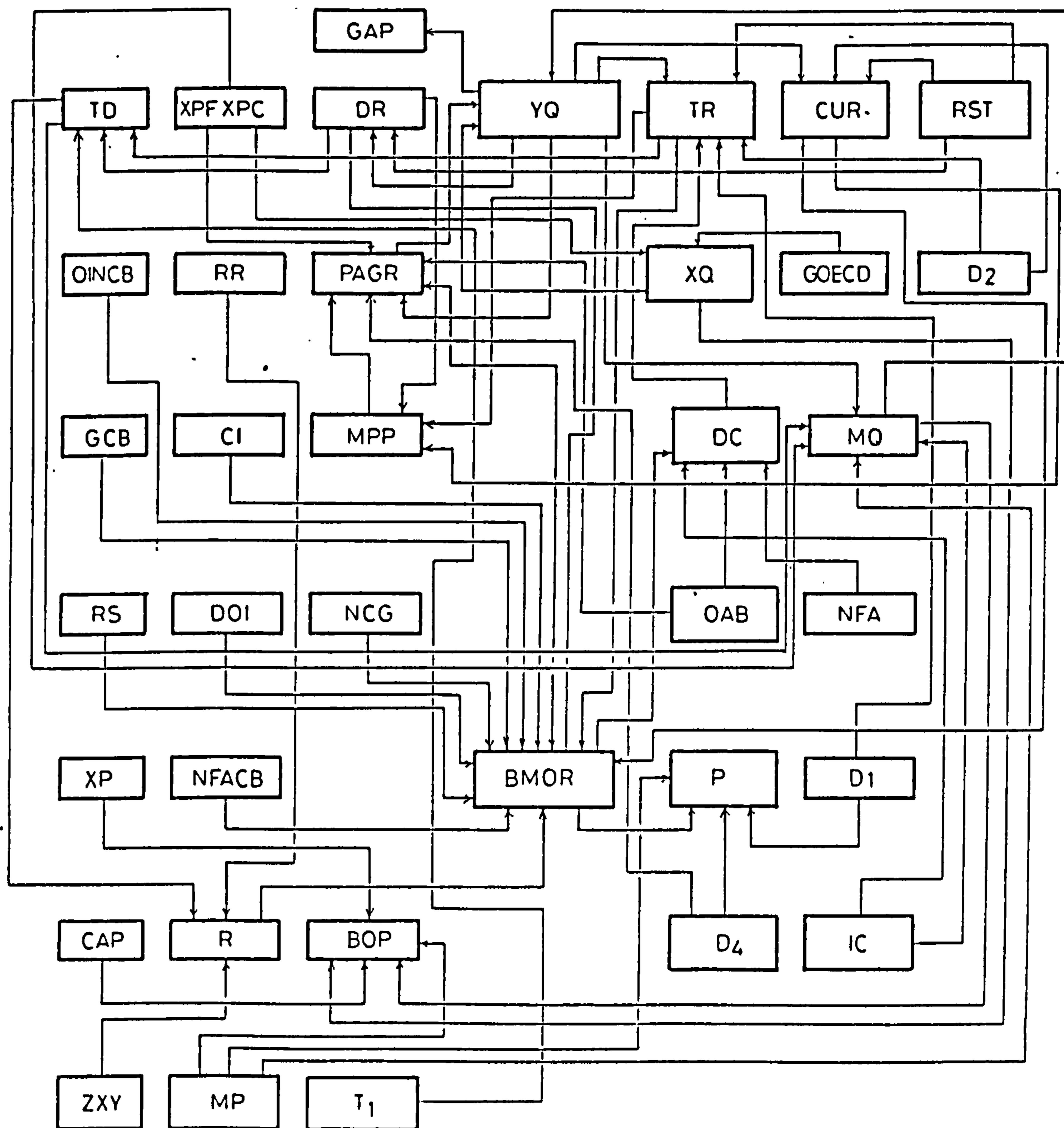
$$\begin{aligned} \text{LnXQ} = & 4.7335 - .42448 \text{ LnXP/XPC} + .01443 \text{ LnXQ}(-1) + .04187\text{D1} \\ & (6.34289) \quad (-4.17353) \quad (.11824) \quad (1.03160) \\ & - .04632\text{D2} + .03285\text{D3} - .32195\text{DP} + .00215\text{X*} \\ & (-1.18377) \quad (.80619) \quad (-3.71859) \quad (5.42233) \end{aligned}$$

$$\bar{R}^2 = .87548$$

$$\text{D.W.} = 1.80$$

$$\bar{R}^2 = .8432$$

FLOW DIAGRAM OF THE MODEL



Appendix 4.3

Abbreviations used in the Flow Diagram

GAP	= Excess capacity/excess demand
TD	= Total deposits
XPFXPC	= Real foreign currency price of exports as a ratio of the export prices of competing countries
DR	= Real demand deposits
YQ	= Real Income
TR	= Real time and savings deposits
CUR	= Real currency
RST	= Nominal rate of interest
OINCB	= Other items (net) of the Central Bank
RR	= Required reserves
PAGR	= Real total expenditure
XQ	= Volume of exports
GOECD	= Growth of OECD countries
D2	= Seasonal dummy (quarter 2)
GCB	= Gross credit to commercial banks by the Central Bank
CI	= Total currency issue of the Central Bank
MPP	= Real import price in home currency
DC	= Domestic credit
MQ	= Volume of imports
RS	= Deposits of other institutions held with the Central Bank
DOI	= Gross credit to other institutions by the Central Bank
NCG	= Net credit to government by the Central Bank
OAB	= Other assets (net) of the banking system
NFA	= Net foreign assets of the banking system
XP	= Real export price
NFACB	= Net foreign assets of the Central Bank
BMOR	= Real broad money
P	= Aggregate price level (GDP deflator)
D1	= Seasonal dummy (quarter 1)
CAP	= Capital account of the balance of payments
R	= Total reserves of commercial banks
BOP	= Balance of payments
D4	= Seasonal dummy (quarter 4)
IC	= Volume of import credit
ZXY	= Lending rate in the Inter- bank call market
MP	= Nominal price of imports
T1	= Long term deposits of government and government sponsored institutions

Appendix 4.4

Otani/Riechel Smoothing Technique

This method relies on the principle of moving averages. The first quarter data for example are equal to one fourth of the annual income of the current year plus three fourths of the income of the previous year. Second quarter data are obtained by giving the weight of one half to the current and the previous periods income. The weights for the third quarter are three fourths and one fourth and the moving average for the fourth quarter (expressed as in annual rate) is equal to the annual income of the current year.

GDP_t - annual GDP for the current year
 GDP_{t-1} - annual GDP for the previous year

$$\text{First estimate for first quarter } \frac{(3 \times \text{GDP}_{t-1}) + (\text{GDP}_t)}{16}$$

$$\text{First estimate for second quarter } \frac{(2 \times \text{GDP}_{t-1}) + (2 \times \text{GDP}_t)}{16}$$

$$\text{First estimate for third quarter } \frac{(1 \times \text{GDP}_{t-1}) + (3 \times \text{GDP}_t)}{16}$$

$$\text{First estimate for fourth quarter } \frac{4 \times \text{GDP}_t}{16}$$

$$\text{Sum of the first estimates for all four quarters} = \hat{\text{GDP}}_t$$

$$\text{Final estimate for first quarter (first estimate)} \times \frac{\hat{\text{GDP}}_t}{\text{GDP}_t}$$

$$\text{Final estimate for second quarter (first estimate)} \times \frac{\hat{\text{GDP}}_t}{\text{GDP}_t}$$

Final estimate for third quarter (first estimate) x GDP_t
 $\frac{\hat{\Delta} \text{GDP}_t}{\text{GDP}_t}$

Final estimate for fourth quarter (first estimate) x GDP_t
 $\frac{\hat{\Delta} \text{GDP}_t}{\text{GDP}_t}$

Appendix 4.5

Two stage least squares principal components (2SLSPC)

Demand for real currency.

$$[1'] \text{ Ln (CU/CP) } = -1.341 + .472 \text{ Ln YQ } + .742 \text{ Ln (CU/CP) } (-1) \\ (-1.61*) \quad (6.75) \quad (7.57)$$

$$-.373 \text{ Ln RST } + .062 \text{ D2 } \\ (-4.32) \quad (3.27)$$

$$\text{SE} = .042 \quad h = -1.24 \quad n = 32$$

Demand for real demand deposits.

$$[2'] \text{ Ln (D/CP) } = 2.374 + .158 \text{ Ln YQ } (-4) + .645 \text{ Ln (D/CP) } (-4) \\ (1.96*) \quad (1.71*) \quad (3.28)$$

$$-.316 \text{ Ln RST } \\ (-3.08)$$

$$\text{SE} = .062 \quad h = .93 \quad n = 32$$

Demand for Real time and savings deposits.

$$[3'] \text{ Ln (T/CP) } = 2.924 + .191 \text{ Ln YQ } (-1) - .225 \text{ Ln RST } \\ (3.32) \quad (1.71*) \quad (-1.81*)$$

$$+ .510 \text{ Ln DC } -.122 \text{ D1 } \\ (13.31) \quad (-5.18)$$

$$\text{SE} = .053 \quad \text{DW} = 1.29 \quad \text{RHO} = .39 \quad n = 32$$

Total reserves.

$$[4'] \text{ Ln R } = -.312 - .214 \text{ Ln ZXY } + .443 \text{ Ln TD } + .543 \text{ Ln RR } \\ (-.292*) \quad (-2.42) \quad (1.66*) \quad (2.53)$$

$$\text{SE} = .074 \quad \text{DW} = .95 \quad \text{RHO} = .53 \quad n = 32$$

Total real expenditure.

$$\begin{aligned} [9'] \text{ Ln (PAG/P)} &= 1.155 + .598 \text{ Ln YQ}(-3) + .299 \text{ Ln (BMO/CP)}(-1) \\ &\quad (1.47^*) \quad (4.94) \quad (2.78) \\ &+ .163 \text{ D4} \\ &\quad (4.28) \end{aligned}$$

$$\text{SE} = .077 \text{ DW} = 1.79 \text{ n} = 32$$

Aggregate price level.

$$\begin{aligned} [10'] \text{ Ln P} &= -2.443 + .676 \text{ Ln MP}(-2) + .429 \text{ Ln (BMO/CP)}(-2) \\ &\quad (-3.37) \quad (5.51) \quad (5.86) \\ &+ .050 \text{ D1} - .056 \text{ D4} \\ &\quad (5.89) \quad (-6.49) \end{aligned}$$

$$\text{SE} = .029 \text{ DW} = .29 \text{ RHO} = .93 \text{ n} = 32$$

Volume of real imports.

$$\begin{aligned} [11'] \text{ Ln MQ} &= 4.910 + .246 \text{ Ln YQ}(-2) - .417 \text{ Ln MP}(-4) \\ &\quad (3.92) \quad (2.39) \quad (-2.95) \\ &+ .458 \text{ Ln IC}(-1) \\ &\quad (7.27) \end{aligned}$$

$$\text{SE} = .057 \text{ DW} = 1.18 \text{ RHO} = .43 \text{ n} = 32$$

Volume of real exports.

$$\begin{aligned} [12'] \text{ Ln XQ} &= -2.268 + 1.310 \text{ Ln GOECD}(-4) - .257 \text{ XPFXPC}(-4) \\ &\quad (-1.44^*) \quad (4.87) \quad (-4.47) \\ &+ .322 \text{ Ln XQ}(-1) \\ &\quad (4.10) \end{aligned}$$

$$\text{SE} = .049 \text{ h} = 1.27 \text{ RHO} = -.37 \text{ n}=32$$

CHAPTER 5

SIMULATION

This chapter contains four main sections. 5.1 outlines the methodology of simulation and discusses its uses in this thesis. A dynamic control solution of the model for the period 1978 Q1 to 1985 Q4 is carried out in section 5.2. Section 5.3 deals with the validation of the model based on sensitivity and multiplier analysis and discusses the ability of the model to forecast and to capture turning points in the major endogenous variables. It also compares OLS simulation results with those obtained from more efficient estimation techniques, in particular 2SLSPC. The overall performance of the model is discussed in conclusion. All simulation experiments were carried out with the Time Series Processor (TSP-version 3.5) at the University of Bradford.

5.1 The Methodology of Simulation

According to Pyndick and Rubinfeld (1986) simulation is the mathematical solution of a simultaneous set of difference equations. It is a popular technique for testing and evaluating economic models and for forecasting and policy analysis.

The main purpose of simulation here is to provide both a computationally convenient solution to our set of equations, especially in view of the time lags and

nonlinearities involved. Secondly, it enables us to evaluate the system as a whole in a dynamic context. Equations which display an acceptable statistical fit on an individual basis need not perform well when simulated as part of a complete model, and equations which are not very satisfactory when taken in isolation may perform better in a simulation context. In this sense, simulation provides an additional check on the statistical fit of the model in a dynamic context. Thirdly, simulation enables us to assess the tracking performance of our model. Fourthly, simulation enables us to carry out repeated solutions of our model using different values for the parameters based upon alternative estimation methods. For example, OLS and 2SLSPC. We also changed some of the key parameters in the equations to carry out "Sensitivity Analysis" to see how sensitive the model is to small changes in the parameters, and to simulate policy changes. This is particularly important in so far as we are interested in assessing the dynamic repercussions of the MTM through the model. Fifthly, we were interested to test the accuracy of the model in replicating turning points in the actual data. A model may track the levels of variables well, but perform poorly in predicting changes of direction. We will therefore, compare year on year directional changes in observed and simulated values and assess the effects of taking sub-periods within the sample period. For a good review see Wilson (1980).

We also chose simulation because it enables us to assess the impact of "exogenous shocks" on the endogenous variables and their time paths using multiplier analysis. For example, a fiscal policy related component (NCG) of the money supply could be varied and its impact on endogenous variables such as the price level can be assessed. Multiplier analysis is also useful in demonstrating the interactions between different sectors of the economy and isolating the MTM. Both policy and non-policy exogenous variables can be used for this purpose and it helps shed light on future policy in as much as it enables us to construct counterfactual exercises with historical data. Finally, we use ex post forecasting to assess how the model tracks actual historical data, both within and outside the sample period. It is not our intention, however, to conduct ex ante forecasting, in view of the well known problems associated with this analysis. See, for example, Pyndick and Rubinfeld (1986).

We begin our evaluation procedure with a control solution of the model over the sample period and inspect its within sample tracking performance in line with conventional criteria. We then examine the model's outside sample tracking performance by re-estimating the model over a shortened time period and using it to carry out an ex post forecast over the rest of the sample. The actual and forecast values for the endogenous variables are then compared in order to assess the magnitude of forecasting

errors.

To complete our evaluation of the model we use sensitivity analysis to compare the system's performance when changes are made to the simulation sample period and parameters and equations in the model. We then call upon dynamic response analysis to calculate dynamic multipliers and elasticities measuring the repercussions on the endogenous variables of shocks to selected exogenous variables.

5.2 Dynamic Simulation-Control Solution 1978 Q1-1985 Q4

The model containing 8 equations and 6 identities was dynamically simulated over the estimation period of 32 observations from the first quarter of 1978 to the fourth quarter of 1985. This represents an unconditional ex post historical simulation in which the actual values of the exogenous variables are used to perform a dynamic one step ahead solution. The simulation was dynamic in the sense that the solution values from previous time periods are used for the lagged endogenous variables in place of their historically observed values.

The tracking performance of the model is summarised in Table 5.1 using the root mean square percentage error (RMSPE) and Theil's inequality coefficient (U)^{1/}. The former measures the deviation of the simulated endogenous variable from its actual time path in percentage terms and is therefore independent of the units used to measure the

different variables. However, in the case of the balance of payments (BOP), which involves switching between positive and negative values, the RMSPE is inappropriate

Table 5.1
Simulation Tracking Performance for the Control Solution
1978 Q1 to 1985 Q4

	RMSPE	U	UM	US	UC
[1] Real currency	8.55	.044	.453	.026	.521
[2] Real demand deposits	6.44	.032	.074	.319	.607
[3] Real time/savings deposits	9.07	.044	.206	.010	.784
[4] Total reserves	13.64	.058	.021	.114	.865
[9] Total real expenditure	8.52	.043	.258	.011	.732
[10] Aggregate price level	9.26	.045	.001	.723	.276
[11] Volume of real imports	5.57	.028	.049	.219	.732
[12] Volume of real exports	4.24	.021	.001	.024	.975
[13] Real income (GDP)	9.73	.049	.235	.001	.765
[14] Balance of payments 1/	(650)	.174	.067	.121	.810
[5] Total deposits	6.39	.029	.175	.001	.825
[6] Real broad money	5.69	.028	.387	.006	.607
[8] Domestic credit	4.34	.019	.350	.010	.641
[15] Excess demand/capacity	10.56	.054	.226	.183	.591
Arithmetic mean 2/	7.85				

1/ Root Mean Square Error
2/ excludes the BOP.

and the root mean square error (RMSE) is used in its place. U is related to the RMSPE but the denominator is scaled such that U always falls between zero and unity. U=0 implies a perfect fit between the actual and simulated series, while U=1 suggests that the predictive performance of the model is as bad as it could possibly be. Table 5.1 also shows the decomposition of U into inequality proportions which breaks the simulation errors down into their characteristic sources, namely bias (UM), variance

(US), and covariance (UC). The UM measures the extent to which the average values of the simulated and actual series deviate from each other. The US arises because the solution values which the system generates given the observed values of the predetermined variables do not coincide exactly with the values predicted by each estimated equation for the given endogenous variable. Finally, the UC measures the unsystematic error. It represents the remaining error after deviations from the average values and average variabilities have been accounted for. A visual display of the model's tracking performance is provided by Figures 1 to 14 (Appendix 5.1).

Although there are no hard and fast criteria for evaluating the performance of macro-simulation models (MSMs), the data in table 5.1 and the visual comparison of the actual and simulated series suggest that the tracking performance of the model is good. The average RMSPE of 7.85 is of an acceptable order of magnitude, and only the total reserves and excess demand equations exhibit RMSPE exceeding 10 per cent. U statistics exceed .05 for both these equations and also for the BOP. In the case of reserves, most of the error seems to be accounted for by the unsystematic UC component, which is generally considered to be less of a problem than high values for UM or US. The excess demand/capacity equation, despite its high UM, is not really central to the model since it does not appear on the right hand side of any relationship and is simply

used to give a broad indication of the relationship between simulated and potential real GDP. The relatively high RMSE and U for the BOP is also to be expected since it is a residual aggregate which is notoriously difficult to predict in absolute terms. It too does not play a major role elsewhere in the system, but only becomes important in a multiplier context when changes in this identity are of interest rather than absolute values. Of greater concern is the relatively high systematic error UM , for real currency and real broad money, since this usually indicates that revision of the model might be necessary.

However, these UM values are not especially high and the visual tracking performance for these equations does not suggest a serious problem. The variance component US is relatively high for the aggregate price level equation and real demand deposits. In the latter case this is clearly because the actual series has fluctuated much more than the simulated series, as a glance at Figure 4 would suggest. In the level case this is much less obvious from Figure 6. In neither of these cases, however, is this error serious enough to distort the overall simulation performance of the equations concerned.

Table 5.2 compares the performance of our model, where the equations overlap sufficiently, with the earlier SEACEN Sri Lanka study. Although the two models are not identical and the time periods are different, it seems that we have managed to improve the tracking performance of the

model overall on the basis of the average RMSPE and for

Table 5.2
The SEACEN Sri Lanka Study and the
Control Solution Compared

	RMSPE	
	1974-1979	1978-1985
[1] Real currency	10.19	8.55
[2] Real demand deposits	13.47	6.44
[3] Real time/savings deposits	4.32	9.07
[4] Total reserves	5.03	13.64
[9] Total real expenditure 1/	12.86	8.52
[10] Aggregate price level	13.54	9.26
[11] Volume of real imports	19.87	5.57
[12] Volume of real exports	7.57	4.24
[13] Real income (GDP)	9.21	9.73
[14] Balance of payments 2/	1359	650
[5] Total deposits	-	-
[6] Real broad money	22.73	5.69
[8] Domestic credit	-	-
[15] Excess demand/capacity	-	-
Arithmetic mean 3/	11.88	8.07

1/ Private expenditure only for SEACEN

2/ Refers to RMSE

3/ excludes the BOP.

most equations. Finally, we looked at the ability of the model to capture turning points in the data.

Table 5.3 summarizes our findings. (A) counts the number of occasions on which the simulated series fails to match a turning point in the actual data, and (B) counts the times that the simulated series changes direction but the actual series does not. Overall, there is no obvious tendency for either (A) or (B) to predominate. Equations which perform relatively badly on these criteria are the BOP, real imports, the aggregate price level (especially on

(A)) real exports, and time and savings deposits [especially (B)]. (C) is designed to see if there is any evidence that an equation systematically over or under predicts the actual data by taking the ratio of positive to negative simulation errors. A value of unity for (C) would suggest that there is no tendency for systematic over or under prediction. From Table 5.3 it appears that the simulated series tend, in general, to under rather than to over predict the actual series {(C) less than unity}. The real currency and domestic credit equations are the most prone to under-prediction, while the price level equation systematically over-predicts for the first 21 quarters and then under-predicts for the remaining 11 quarters.

Overall, it is encouraging that only the BOP equation seems to do badly over the range of evaluation criteria, including the visual display, we have been using. Thus, whilst it is suggestive of improvement, there is no compelling reason to alter the specification of the model in the light of the performance of the control solution.

Table 5.3
Turning Point Analysis for the Control Solution

TURNING POINTS			
	(A)	(B)	(C)
	In actual but not in simula- ted	ted but not in actual	Positive/ negative simulation errors
[1] Real currency	3	2	.28
[2] Real demand deposits	2	5	.68
[3] Real time/savings deposits	2	6	.52
[4] Total reserves	3	2	.52
[9] Total real expenditure	5	0	.45
[10] Aggregate price level	8	4	1.90
[11] Volume of real imports	6	7	.60
[12] Volume of real exports	6	5	.88
[13] Real income (GDP)	4	0	.45
[14] Balance of payments	5	8	1.50
[5] Total deposits	1	5	.39
[6] Real broad money	0	1	.39
[8] Domestic credit	0	5	.33
[15] Excess demand/capacity	4	0	.45
Total	49	50	

5.2.1 Benchmark Comparison

Table 5.4 compares the tracking performance of our model with a 'naive' benchmark alternative which predicts that the value of the endogenous variable in question will be identical to its actual value in the previous time period. This is a mechanical extrapolation rule not based on economic theory. The tracking performance of this naive model is expected to be quite good, since it combines the trend which is prominent in most macro data, with lagged dependent variables which tend to capture the fluctuating part of the variables. Figures 15 to 28 provide the graphical presentation (Appendix 5.2).

Table 5.4
Comparison of the Tracking Performance
of the Control Solution and a Naive Benchmark Model

	RMSPE		U	
	CONTROL	NAIVE	CONTROL	NAIVE
[1] Real currency	8.55	6.45	.044	.032
[2] Real demand deposits	6.44	10.65	.032	.053
[3] Real time/savings deposits	9.07	9.41	.044	.046
[4] Total reserves	13.64	15.36	.058	.067
[9] Total real expenditure	8.52	8.23	.043	.041
[10] Aggregate price level	9.26	7.75	.045	.038
[11] Volume of real imports	5.57	9.51	.028	.047
[11] Volume of real exports	4.24	7.43	.021	.037
[13] Real income (GDP)	9.73	13.22	.049	.066
[14] Balance of payments 1/ (650)		(490)	.174	.125
[5] Total deposits	6.39	6.47	.029	.029
[6] Real broad money	5.69	7.96	.028	.039
[8] Domestic credit	4.34	5.80	.019	.027
[15] Excess demand/capacity	10.56	14.87	.054	.073
Arithmetic mean 2/	7.85	9.47		

1/ Root Mean Square Error

2/ excludes the BOP.

Overall, the control solution performs better than the naive model, with a significantly lower average RMSPE. Only two equations perform better with the naive model: those for real currency and the aggregate price level: and the total real expenditure equation does marginally better in the latter case. Although this reinforces our suspicions from 5.1 that there is room for improvement with respect to these two equations, the magnitude of their simulation errors is not such as to raise fundamental doubts about their inclusion in the model.

5.3. Validation of the Model

5.3.1 Outside Tracking Performance

In order to evaluate the model's ability to track the historical paths of the endogenous variables over a period which lies outside the estimation sample period, we re-estimated the equations from the first quarter of 1978 to the last quarter of 1984 and carried out an ex post^{2/} forecast over the four quarters of 1985. The results are summarised in Table 5.5. Although aggregates such as real GDP and excess demand have relatively high forecasting errors, the overall performance of the model is significantly biased by the equation for total reserves, which seems especially sensitive to the choice of estimation time period. Without this equation, the average RMSPE is quite acceptable at 8.59.

5.3.2. Sensitivity Analysis

As a further check on the dynamic stability of the model, we decided to carry out three sensitivity exercises to ascertain the implications of changing the solution time period, using an alternative estimation technique, and altering the values of individual parameters by specific amounts.

Table 5.5
Ex Post Forecasting from 1985 Q1 to 1985 Q4

	RMSPE	U
[1] Real currency	4.04	.016
[2] Real demand deposits	7.52	.036
[3] Real time/savings deposits	8.25	.029
[4] Total reserves	51.26	.125
[9] Total real expenditure	10.75	.045
[10] Aggregate price level	9.68	.034
[11] Volume of real imports	3.37	.014
[12] Volume of real exports	6.47	.028
[13] Real income (GDP)	16.67	.071
[14] Balance of payments 1/	892.3	.157
[5] Total deposits	7.98	.023
[6] Real broad money	7.08	.027
[8] Domestic credit	7.39	.022
[15] Excess demand/capacity	13.83	.071
Arithmetic mean 2/	11.87	

1/ Root Mean Square Error

2/ excludes the BOP.

Table 5.6
Sensitivity of the Model to a Change in Solution
Time Period

	RMSPE		U		RMSPE
	79-84	81-85	79-84	81-85	CONTROL
[1] Real currency	9.81	4.21	.050	.021	8.55
[2] Real demand deposits	6.93	5.93	.035	.029	6.44
[3] Real time/savings deposits	9.72	7.72	.045	.032	9.07
[4] Total reserves	14.64	16.81	.058	.058	13.64
[9] Total real expenditure	8.86	4.74	.043	.021	8.52
[10] Aggregate price level	9.32	10.12	.044	.042	9.26
[11] Volume of real imports	5.31	3.90	.026	.018	5.57
[12] Volume of real exports	4.33	3.52	.021	.016	4.24
[13] Real income (GDP)	9.60	5.94	.048	.027	9.73
[14] Balance of payments 1/	(663)	(600)	.166	.131	(650)
[5] Total deposits	6.91	6.96	.029	.026	6.39
[6] Real broad money	6.52	4.35	.032	.019	5.69
[8] Domestic credit	4.94	3.91	.019	.019	4.34
[15] Excess demand/capacity	9.93	5.97	.051	.028	10.56
Arithmetic mean 2/	8.22	6.47			7.85

1/ Root Mean Square Error

2/ excludes the BOP

Table 5.6 compares the control solution 1978 to 1985 with the results for two sub periods: 1979 to 1984 and 1981 to 1985. The first period was chosen to test the stability of our model to changes in monetary policy since 1979. The second was to see the sensitivity of the model to changes in the endogenous variables associated with the effects of stabilisation policies. Although the model simulates better over the later period, especially the equations for real currency, real income, excess demand, and total real expenditure; there is little evidence to suggest that the model is particularly sensitive to the solution period selected.

Table 5.7 contrasts the control solution RMSPE's for the OLS estimates discussed in 4.8 with those based upon 2SLSPC, with an autocorrelation correction where appropriate. The rationale behind the 2SLSPC procedure is to reduce the possibility of inconsistency in the OLS estimates arising from the model's simultaneity, and the autocorrelation correction is used to improve the efficiency of these results by adding information about the error terms concerned. Although there has been very little research in this area, there is some evidence to suggest that both these procedures improve the simulation performance of macro models^{3/}. This is confirmed insofar as the average RMSPE is lower with 2SLSPC and no equation does dramatically better with the OLS estimates. However, an inspection of the full results for the individual equations

in (Appendix 4.5), raises some specification problems with respect to the equations for total reserves [4] and time and savings deposits [3]. The coefficient on the total deposits variable (TD) is now insignificant in the reserves equation, and those for lagged income and interest rates are significant only at 10 per cent in the time and savings deposits equation. In addition, the sign on the interest rate variable (RST) is contrary to a priori expectations.

Table 5.7
The Control Solution with Ordinary Least Squares and Two
Stage Least Squares Principal Components Estimates

RMSPE		

	OLS	2SLSPC

[1] Real currency	8.55	8.47
[2] Real demand deposits	6.44	5.75
[3] Real time/savings deposits	9.07	7.01
[4] Total reserves	13.64	11.52
[9] Total real expenditure	8.52	7.20
[10] Aggregate price level	9.26	9.19
[11] Volume of real imports	5.57	5.62
[12] Volume of real exports	4.24	4.25
[13] Real income (GDP)	9.73	8.26
[14] Balance of payments 1/	(650)	(652)
[5] Total deposits	6.39	5.35
[6] Real broad money	5.69	5.41
[8] Domestic credit	4.34	4.49
[5] Excess demand/capacity	10.56	9.06

Arithmetic mean 2/	7.85	7.04

1/ Root Mean Square Error

2/ Excludes the BOP

Our final sensitivity test consisted of a series of control runs with a given parameter increased by half of the standard error of the estimated coefficient concerned. The objective here is to obtain a feel for the sensitivity of the model to particular parameter estimates. Since the model is nonlinear, the only way to do this is by trial and error to see how the model performs. We varied 22 parameters in all, excluding only the dummy variables and the constants. We then calculated the average RMSPE for each run and the percentage of the total RMSPE across all 22 runs accounted for by a given parameter change. By far the most sensitive coefficient was that for the lagged dependent variable in the real currency equation [1] (a2). This alone accounted for 89 per cent of the total RMSPE.

Table 5.8 lists the share of the overall error accruing to the 3 other most sensitive parameters which together account for about 80 per cent of the total error excluding the a2 change. Further investigation of the average RMSPEs for the individual equations suggests that the impact of the changes in a2 and a1 are transmitted via the currency equation to the broad money (BMO/CP) and domestic credit (DC) identities and then on to the rest of the model. Changes in e1 and e2 also affect these identities strongly, but operate indirectly via total real spending (PAG/P) and the real income identity (YQ). It appears, therefore, that the real currency and real total expenditure equations are key elements in the structure of

the model and that the system as a whole is especially sensitive to the specification of these equations. It is encouraging, however, that both a_2 and the other coefficients in Table 5.8 display a good statistical fit on the basis of the criteria used in 4.7.

Table 5.8
Parameter Sensitivity Test

EQUATION	VARIABLE	COEFFICIENT	SHARE OF TOTAL ERROR 1/
[9] Total real expenditure	Ln YQ(-3)	e1	38.9
[9] Total real expenditure	Ln(BMO/CP)(-1)	e2	26.5
[1] Real currency	Ln YQ	a1	13.5
TOTAL			78.9
1/ Percentage of total RMSPE over 22 parameter changes excluding a_2			

5.3.3. Dynamic Multipliers and Elasticities

The final step in our evaluation procedure was to calculate dynamic multipliers and elasticities by shocking selected exogenous variables in turn and assessing the deviation of the disturbed solution from the undisturbed (control) solution. Since our model is nonlinear in the variables, multipliers and elasticities can only be obtained by carrying out simulation experiments.

Our objective here is three-fold. Firstly, to obtain information on the dynamic structure of the model as part of the general evaluation procedure. Secondly, to ascertain the model's performance in the context of the

earlier SEACEN country studies, especially that pertaining to Sri Lanka, before engaging in a full policy-oriented analysis. Thirdly, to assess the importance of alternative transmission paths which will facilitate the identification of the important transmission channels in the next chapter.

Our approach here is, therefore, heavily constrained by the SEACEN (1981) framework, although a direct comparison between our study and SEACEN is difficult insofar as the various country studies differ in model specification and in the precise way in which the multipliers are calculated and presented. In model specification, for example, it is not always clear how each country has defined the relationship between the BOP and the broad money identity for purposes of simulation. In some cases it appears that net foreign assets (NFA) are treated endogenously such that a shock to a component of the BOP would have direct feedback effects on the monetary sector, whilst in other cases both a BOP component and a NFA variable in the money identity are disturbed simultaneously^{4/}. The overall repercussions on the system will not be the same. We shall return to this point below.

In addition, although a comparison between the individual studies is enhanced by the adoption of a standard set of monetary shocks based upon a 2.5 percentage increase in the required reserve ratio and a 5 per cent increase in reserve money (RM), the precise way in which the

change in RM is brought about varies (changes in exports, imports, capital flows). Finally, although some trouble is taken to present the results of the multiplier experiments in a common format, the actual presentation still differs between the countries concerned and there is not usually enough information available to transcribe this into a homogeneous framework. We are limited, therefore, to comparing percentage changes from control for key endogenous variables in specific time periods, and only in the Sri Lankan and Indonesian cases are these changes available for the whole time period. The multipliers concerned appear to have been calculated on the basis of an impulse shock to the starting value of the variable concerned in the first quarter of 1974.

For comparison, therefore, we calculated all multipliers and elasticities on the basis of impulse changes from the starting values of the variables concerned in the first quarter of 1978. In addition to computing percentage changes from control for direct comparison with SEACEN studies, we also calculated unit multipliers and dynamic elasticities. The former provides useful information on the pattern of the responses of the endogenous variables, and the latter provide a better indication of the relative strength of the responses concerned. In the case of interest rates we present the effects in the form of dynamic elasticities as the multiplier effects are distorted as a result of the small

changes in interest rates as compared to the large absolute numbers in the endogenous variables.

We selected 3 multiplier experiments to test the dynamic structure of the model and to compare with SEACEN: an increase in reserve requirements of 2.5 percentage points, a 5 per cent increase in reserve money by raising net domestic assets, and a 5 per cent increase in reserve money by simultaneously increasing NFACB and reducing the volume of imports. The first shock amounts to a contractionary monetary policy, and the second and third to a monetary stimulus, although the transmission mechanisms involved are different. We also conducted two additional simulation experiments to assess the relative significance of interest rates and credit rationing in transmitting monetary impulses to the real sector. The latter two are not comparable with the SEACEN study.

The purpose of these experiments within the SEACEN framework is essentially to shed light on the relationship between monetary impulses (policy and non-policy) and real sector variables through the spillover effect of excess money. For example, if the money supply [6] is increased through one of the channels above, this excess money is hypothesised to spill over into higher spending on home produced goods or imports. In our case, since we do not separate out spending on home goods from spending on imported goods, the increase in the money supply manifests

itself initially in an increase in total domestic spending [9]. This in turn raises real income through the real GDP identity [13] and leads to a worsening of the BOP [14] via the import function [11], and a decline in the gap between actual and potential output [15]. At the same time, excess money raises the prices of domestic goods via [10] and leads to a decline in real output in the long run.

Table 5.9 presents the multipliers and elasticities for the first experiment in which the required reserve ratio is increased by 2.5 percentage points^{5/}.

Table 5.9

Dynamic Multipliers and Elasticities for a 2.5 per cent Increase in the Required Reserve Ratio

UNIT MULTIPLIERS						DYNAMIC ELASTICITIES				
Period	Real Broad Money	Real Income	Price Level	Balance of Pay- -ments	Real Broad Money	Real Income	Price Level	Balance of Pay- -ments	Period	
Impact										
1978 1	-1.89	0	0	0	-.053	0	0	0	1	
Delay										
1978 2	-.183	-1.13	0	0	-.007	-.051	0	0	2	
3	-.306	-.106	-.004	0	-.012	-.005	-.032	0	3	
4	-.133	-.018	-.000	.104	-.006	-.001	-.003	.074	4	
1979 1	-.175	-.512	-.001	.011	-.009	-.029	-.005	.011	1	
2	-.305	-.139	0	.002	-.015	-.009	-.003	.002	2	
3	-.162	-.094	-.001	.062	-.009	-.006	-.004	.052	3	
4	-.166	-.311	-.001	.018	-.009	-.019	-.007	.014	4	
Intermediate										
1980 2	-3.69	-2.54	-.009	.248	-.011	-.009	-.004	.096	10	
1982 4	-4.70	-3.51	-.011	.424	-.006	-.008	-.003	.014	20	
1985 2	-5.18	-3.91	-.013	.510	-.006	-.007	-.003	.01	30	
Long- Run										
1985 4	-5.25	-3.96	-.013	.523	-.006	-.007	-.003	.01	32	

As expected, the rise in required reserves in equation [4] increases the reserves component of the broad money identity [6] and reduces broad money (BMO/CP) by a unit multiplier of -1.89 in the first quarter of 1978, and in subsequent periods. This then decreases real GDP via equation [9] after a lag by a unit multiplier of -1.13. The intermediate multipliers after 10, 20 and 30 periods have elapsed suggest that the long run impact of the shock decays, but that the long run multipliers are substantially larger than impact effects at -3.69 and -5.25 respectively. The repercussions on the price level and BOP are noticeably smaller, although the BOP effects are delayed longer as a result of the lags involved. The long run BOP multiplier is also significantly larger in magnitude than for shorter periods. The dynamic elasticities confirm the relatively stronger impact on BMO/CP and YQ as compared to P and BOP.

Table 5.9 thus supports the general SEACEN hypothesis about the MTM and the pattern of the multipliers and elasticities over time suggests that the model is dynamically stable, with the endogenous variables converging on their control values and not displaying any obvious oscillatory effects.

Table 5.10 presents the results from the second multiplier run in which RM was raised by 5 per cent in the first quarter of 1978. This was done by increasing net credit to government (NCG), as a proxy for net domestic

assets (NDA). This directly raises the money supply through identity [6] and spills over into real income, prices, and the BOP as before. In this case, however, the effect is expansionary on money, income and prices, and negative in its impact on the BOP. The general pattern of the multipliers and elasticities is similar to the first experiment but they are significantly larger in magnitude.

This suggests that the direct manipulation of RM via NDA is likely to have a stronger effect on the economy than manipulating the money supply indirectly through the reserves of the commercial banks.

Table 5.10
Dynamic Multipliers and Elasticities for a 5 per cent Increase in
Net Credit to Government (NCG)

UNIT MULTIPLIERS						DYNAMIC ELASTICITIES				
Period	Real Broad Money	Real Income Money	Price Level	Balance of Pay- -ments	Real Broad Money	Real Income Money	Price Level	Balance of Pay- -ments	Period	
Impact										
1978 1	4.08	0	0	0	.288	0	0	0	1	
Delay										
1978 2	.381	2.38	0	0	.038	.261	0	0	2	
3	.637	.222	.009	0	.056	.022	.149	0	3	
4	.277	.038	.001	-.216	.018	.003	.010	-.230	4	
1979 1	.364	1.07	.001	-.023	.033	.114	.021	-.041	1	
2	.633	.290	.001	-.004	.059	.035	.010	-.006	2	
3	.337	1.94	.001	-.128	.023	.016	.011	-.139	3	
4	.345	.646	.001	-.038	.023	.049	.017	-.035	4	
Intermediate										
1980 2	7.83	5.32	.016	-.507	.039	.031	.015	-.327	10	
1982 4	9.91	7.30	.030	-1.38	.073	.009	.004	-.159	20	
1985 2	10.89	8.12	.033	-1.55	.007	.008	.003	-.109	30	
Long-Run										
1985 4	11.04	9.27	.034	-1.58	.004	.005	.002	-.008	32	

In contrast to the first two experiments where the shock emanates from a monetary element in the domestic economy, our third shock involves the foreign sector. We raised RM by 5 per cent as before but achieved this by simultaneously increasing net foreign assets of the Central Bank (NFACB), and reducing the volume of imports. The results are presented in Table 5.11. As expected, the impact on the economy is expansionary, but unlike in the previous experiment, the BOP improves with the monetary expansion as a result of the initial fall in imports. The pattern of multipliers and elasticities is similar to the first two experiments in terms of the relative impact of the shock on the variables concerned and in their stability and convergence properties, but a closer inspection of the elasticities suggests that this shock has proportionately more powerful repercussions on the economy than the previous two shocks.

Although our model is not strictly comparable with the SEACEN country study for Sri Lanka, since we have made some changes in specification and use a later time period, Tables 5.12 to 5.14 compare our multiplier results with the earlier study measured in terms of percentage changes from control. In Table 5.12, where the required reserve ratio is increased, the impact multiplier on broad money is similar in magnitude, but the subsequent pattern of effects is not the same. In the SEACEN case, the shock has a positive impact after only one period but becomes negative

Table 5.11
Dynamic Multipliers and Elasticities for a 5 per cent
Decrease in Import Volume

UNIT MULTIPLIERS					DYNAMIC ELASTICITIES				
Period	Real Broad Money	Real Income	Price Level	Balance of Pay- -ments	Real Broad Money	Real Income	Price Level	Balance of Pay- -ments	Period
Impact									
1978 1	4.262	1.00	0	1.00	2.36	.657	0	19.77	1
Delay									
1978 2	.682	2.49	0	0	.342	1.37	0	0	2
3	.768	.244	.009	.092	.357	.129	.823	1.39	3
4	.449	.574	.002	.226	.211	.294	.131	1.70	4
1979 1	.636	1.20	.002	.026	.404	.892	.178	.317	1
2	.791	.376	.001	.059	.437	.275	.099	.564	2
3	.493	.470	.002	.144	.259	.292	.142	1.19	3
4	.549	.786	.002	.049	.269	.445	.156	.343	4
Intermediate									
1980 2	9.67	7.89	.019	1.76	.306	.33	.136	2.26	10
1982 4	12.63	10.69	.029	2.27	.108	.126	.054	.224	20
1985 2	14.01	11.86	.033	2.53	.058	.065	.025	.096	30
Long-Run									
1985 4	14.21	12.03	.034	2.56	.045	.051	.002	.079	32

again by the seventh quarter. It is difficult to see why this should be so even by inspecting their model, since the changes in RM remain positive until the eighth quarter and the other components of the money identity are either unaffected by the shock or retain the same signs up to the fourth period. In our case the shock has a consistent but decaying negative effect on broad money as one might expect from this impulse multiplier. This picture is repeated for the other endogenous variables in Table 5.12: the effects in our case are similar in magnitude but more distributed and delayed, and do not display the same asymmetries in

sign as in the SEACEN Sri Lanka experiments. Although some of this can be rationalised in terms of the generally more complex lag structure embodied in our model, some of the asymmetries displayed in the SEACEN model are not easy to explain.

Table 5.12
Percentage Changes from Control for a 2.5 per cent Increase in
the Required Reserve Ratio

1974-1978					1978-1985				
% CHANGE FROM CONTROL					% CHANGE FROM CONTROL				
Period	Real Broad Money	Real Income	Price Level	Balance of Pay- ments	Real Broad Money	Real Income	Price Level	Balance of Pay- ments	Period
1974 1	-3.32	0	0	0	-2.56	0	0	0	1978 1
2	.57	-.84	-.47	2.1	-.24	-1.61	0	0	2
3	.36	.06	-.33	8.12	-.38	-.15	-.99	0	3
4	.17	.19	-.27	3.97	-.16	-.02	-.09	2.05	4
1975 1	.06	.15	-.23	.25	-.23	-.78	-.15	.28	1979 1
2	.02	.10	-.21	.16	-.36	-.22	-.06	.04	2
3	-.01	.07	-.18	.04	-.19	-.13	-.09	1.16	3
4	-.02	.05	-.17	NA	-.19	-.41	-.14	.29	4
1976 1	-.03	.03	-.15	-.15	-.24	-.21	-.07	.17	1980 1
2	-.03	.02	-.14	-.22	-.19	-.15	-.07	1.58	2
3	-.03	.02	-.13	-.19	-.14	-.26	-.09	.41	3
4	-.03	.01	-.12	-.15	-.14	-.15	-.07	.24	4
1978 4	-.02	0	-.07	-.05	-.02	-.03	-.01	.04	1985 4

These findings are generally repeated for the other two shocks (see Tables 5.13 and 5.14). However, when credit to government is increased the impact on income is stronger in our case but weaker with respect to the BOP. Just in case our results were influenced by the inclusion of the domestic credit identity [8] which might be expected to magnify the impact of monetary impulses through the system, we excluded this identity and re-ran the multipliers. Although, as expected the multipliers were dampened as a result, the pattern and magnitude of the results were very similar. This identity is not an essential ingredient of the model but is useful in a policy context to test for 'availability' effects.

<p style="text-align: center;"><u>Table 5.13</u> Percentage Changes from Control for a 5 per cent Increase in Net Credit to Government</p>										
1974-1978					1978- 1985					
% CHANGE FROM CONTROL					% CHANGE FROM CONTROL					
Period	Real Broad Money	Real Income	Price Level	Balance of Pay- -ments	Real Broad Money	Real Income	Price Level	Balance of Pay- -ments	Period	
1974 1	5.27	0	0	0	5.09	0	1.93	0	1978 1	
2	-.88	1.3	.72	-3.25	.46	3.15	.18	0	2	
3	-.55	-.09	.51	-12.50	.73	.28	.28	0	3	
4	-.25	-.30	.41	- 6.08	.31	.05	.12	-3.92	4	
1975 1	-.01	-.23	.35	-.38	.44	1.49	.17	-.54	1979 1	
2	-.03	-.15	.31	-.24	.69	.42	.27	-.07	2	
3	-.02	-.11	.28	-.06	.37	.25	.14	-2.21	3	
4	-.04	-.07	.25	-.04	.36	.78	.14	-.56	4	
1976 1	-.05	-.05	.23	.23	.46	.39	.18	-.32	1980 1	
2	-.03	-.03	.21	.32	.36	.29	.14	-3.00	2	
3	-.05	-.03	.19	.28	.26	.49	.10	-.78	3	
4	-.03	-.02	.18	.22	.28	.28	.11	-.46	4	
1978 4	-.05	-.01	.13	.08	.04	.05	.02	-.07	1985 4	

Table 5.14
Percentage Changes from Control for a 5 per cent Decrease
in Import Volume

1974-1978					1978-1985				
% CHANGE FROM CONTROL					% CHANGE FROM CONTROL				
Period	Real Broad Money	Real Income	Price Level	Balance of Pay- -ments	Real Broad Money	Real Income	Price Level	Balance of Pay- -ment	Period
1974	1 4.56	1.84	0	31.68	5.33	1.48	0	44.65	1978 1
	2 4.54	3.10	.59	18.73	.82	3.29	0	0	2
	3 1.58	3.22	1.14	42.04	.88	.32	2.02	3.41	3
	4 .48	1.62	1.31	15.04	.51	.71	.31	4.09	4
1975	1 .12	.77	1.37	.75	.77	1.69	.34	.59	1979 1
	2 -.21	.42	1.36	.28	.87	.54	.19	1.12	2
	3 -.13	.03	1.29	.31	.54	.61	.29	2.49	3
	4 -.03	-.07	1.21	1.73	.57	.95	.33	.73	4
1976	1 -.04	-.07	1.14	.65	.64	.53	.21	.78	1980 1
	2 .09	-.11	1.06	.97	.49	.53	.22	3.65	2
	3 .14	-.13	.99	.93	.40	.62	.25	1.06	3
	4 .17	-.12	.93	.81	.39	.39	.19	.86	4
1978	4 .22	-.08	.70	.35	.06	.07	.03	.11	1985 4

Finally, we compared our results with the table in the SEACEN (1981) study summarising the multiplier results for the country studies. As Table 5.15 suggests, with the clear exception of Singapore for whom the model does not seem to work at all, there is broad support for the SEACEN monetary mechanism in terms of expected signs and magnitudes. In general our results compare favourably with the other country studies, although our model tends to exhibit stronger short run effects on income and weaker effects on the BOP in the long run.

There are, however, some puzzling results for some of the other individual countries. Both Malaysia and Thailand have large long run values for the BOP. These are clearly indicative of instability and cannot be easily explained. It is possible that they arise from the way in which the BOP is related to the money identity through NFA. In our case, when we tried to endogenise NFACB in terms of the BOP instead of simultaneously raising NFACB and reducing imports for the third multiplier, the results were unstable and oscillatory. This may reflect data problems encountered when trying to make the money and BOP identities consistent with each other, but it is also likely to be a direct result of altering the structure of the model. With NFACB endogenised the tracking performance of the model is much worse.

Finally, we considered two simulations which go beyond the SEACEN framework: a 5 per cent rise in interest rates (RST) and a 5 per cent increase in import credit (IC). These are alternative transmission mechanisms and reflect substitution and credit rationing effects respectively. Table 5.16 below presents results of a 5 per cent increase in the RST.

Table 5.15
Policy Simulations for SEACEN Countries and the
Current Study Compared

	Money Supply ^{1/} 2/ t=1	Real Output t=1 t=n	3/ t=n	Balance of Payments t=n	Prices t=n
<u>Increase in required reserves</u>					
Malaysia	- 8.3	-.13	-.01	.23	0
Nepal	-.75	-.04	0.0	.35	-.06
Singapore	-.14	11.30	.61	-1.15	-.67
Sri Lanka 4/	-3.32	-.84	0.0	-.05	-.07
Thailand	-2.60	0.0	.01	12.19	-.63
Current study	-2.56	-1.61	-.03	.04	-.01
<u>Increase in net domestic assets</u>					
Malaysia	4.90	.05	0.0	-.05	0.0
Nepal	4.60	.75	-.05	.02	0.0
Philippines	1.10	.18	-.04	na	.05
Singapore	15.30	13.40	.64	-1.70	-.49
Sri Lanka 4/	5.27	1.30	0.0	.07	.10
Thailand	6.70	5.80	-.07	-38.32	2.12
Current study	5.09	3.15	.05	-.07	.02
<u>Decrease in imports</u>					
Malaysia	1.70	-.02	-.90	-28.30	1.70
Nepal	.64	.16	0.0	4.38	-.06
Singapore	9.70	12.63	.63	-1.51	-.55
Sri Lanka 4/	4.91	1.84	-.02	.37	.55
Thailand	6.70	0.0	-.03	-18.39	1.35
Current study	5.33	1.48	.07	.11	.03

1/ M1, M2, or M3.

2/ Usually 1974 Q1 for SEACEN and 1978 Q1 for the current study

3/ Usually 1978 Q4 for SEACEN and 1985 Q4 for the current study

4/ There is a discrepancy here between the numbers reported in the country study and in the SEACEN summary table 3 We have used the country study figures here.

Table 5.16						
Dynamic Elasticities for a 5 per cent Increase in Interest Rates (RST)						
Period		Real Broad Money	Real Income	Price Level	Balance of Payments	Period

Impact						
1978	1	-0.044	0	0	0	1
Delay						
1978	2	-0.036	-0.032	0	0	2
	3	-0.032	-0.020	-0.017	0	3
	4	-0.025	-0.015	-0.016	0.196	4
1979	1	-0.036	-0.025	-0.013	-0.066	1
	2	-0.020	-0.030	-0.011	-0.049	2
	3	-0.018	-0.015	-0.017	-0.062	3
	4	-0.014	-0.016	-0.009	-0.089	4
Intermediate						
1980	2	-0.020	-0.025	-0.009	-0.024	10
1982	4	-0.004	-0.005	-0.002	-0.010	20
1985	2	-0.001	-0.002	-0.001	-0.002	30
Long- Run						
1985	4	-0.401	-0.361	-0.176	-0.391	32

Table 5.16 suggests that monetary variables react immediately whilst the response from the real sector is delayed. Both monetary and real sector variables were negatively affected, as expected, although the response of the "price level" is much weaker in both the short and long run. The BOP [14] reacts positively in the first few periods but deteriorates thereafter and the response is similar in magnitude to those of real income and real money.

Table 5.17
Dynamic Multipliers for a 5 per cent Increase in
Import Credit (IC)

Period	Real Broad Money	Real Income	Price Level	Balance of Payments	Period
Impact					
1978 1	0	0	0	0	1
Delay					
1978 2	-0.009	-0.087	0	-2.949	2
3	-0.018	-0.006	0	0	3
4	-0.008	-0.007	-0.005	0.686	4
1979 1	-.011	-0.044	-0.009	-0.023	1
2	-0.019	-0.011	-0.004	-0.004	2
3	-0.009	-0.007	-0.006	-0.128	3
4	-0.009	-0.023	-0.010	-0.038	4
Intermediate					
1980 2	-0.014	-0.013	-0.005	-0.029	10
1982 3	-0.004	-0.005	-0.002	-0.007	20
1985 2	-0.002	-0.002	-0.001	-0.003	30
Long-Run					
1985 1	-0.249	-0.331	-0.091	-2.672	32

Table 5.17 reproduces the results of a 5 per cent increase in IC. The impact is clearly negative on all aggregates. The increase in imports [11] and hence the deterioration in the BOP [14] reduces the broad money[6] with one quarters lag. The reduction in broad money then reduces real income and the price level in the long run. In this case the transmission of monetary impulses comes through an alternative channel via BOP and changes in external assets and exerts negative effects on the macro economy. In comparing those two exogenous policy shocks, it seems that although both have negative effects on all the

endogenous variables, the interest rate channel is stronger, especially in terms of the BOP.

Overall, therefore, our model performs well in terms of its dynamic structure producing results which are stable and relatively easy to interpret in the context of the SEACEN framework. More importantly, it is clear that our model is capable of displaying alternative transmission channels of monetary policy.

5.4. Conclusion

When simulated as an entire system the model performed well in terms of a range of evaluation criteria. As in the previous studies, however, the BOP identity was a clear exception across the board. The total reserves equation also displayed some sensitivity to the estimation period and tracked the historical series relatively badly. In general, the model under rather than over predicted the actual series and the real currency and aggregate price equations might benefit from further investigation. The model is also particularly sensitive to the lagged dependent variable and lagged real income variable in the real currency equation, and the coefficients for lagged broad money and lagged income in the equation for total expenditure. There is, however, no evidence that these equations have been seriously misspecified.

Our simulation experiments provide further support for the SEACEN hypothesis about the transmission of mone-

tary policy impulses and their impact upon the money supply, real income, the aggregate price level, and the BOP. All three of our exogenous shocks produced a similar pattern of multipliers and elasticities, which were also stable over the long run. The simultaneous fall in import volume and rise in NFA produced the strongest effects on the system. Our simulations also suggest that the direct manipulation of RM via NDA is likely to have a stronger impact on the economy than the indirect manipulation of the money supply through the reserves of the commercial banks.

When compared to the SEACEN Sri Lanka study, our simulations produce initial percentage changes from control which are similar in magnitude to the earlier study, but are more consistent with respect to sign over the full sample period. This partly reflects the generally more complex lag structure employed in our model, which has the effect of spreading the impulse shock over a longer time period, and some changes in model specification; but there remains a number of asymmetries in the earlier study which are hard to explain and which do not appear in our model.

Finally, when compared to the SEACEN country studies as a whole, our simulations are broadly in line with their findings, although our model tends to have a relatively smaller impact on real income in the short run but stronger effects on the BOP in the long run. The absence of full comparative data for the earlier studies, however,

precludes a more sophisticated comparison. There are also some unstable long run percentage deviations from control for Thailand and Malaysia with respect to the BOP. This may be due to the way in which NFA in the money identity is related to the BOP, since our attempt to endogenise NFA in terms of the BOP produced unstable results. Some thought may need to be given to this relationship, as it is an important ingredient in the MTM and it is not clear how this relationship was actually dealt with in the individual SEACEN country multiplier simulations.

Two additional simulation experiments carried out to investigate two alternative monetary transmission channels, via RST and IC confirmed our a priori expectations, although the interest rate channel seems to be the stronger of the two in terms of relative magnitude.

In sum, therefore, our model performed well in terms of dynamic structure and generated results which are stable and relatively easy to interpret within the context of the SEACEN framework, and should provide a reasonable basis for a more complete analysis of the MTM in Sri Lanka.

FOOT NOTES

1. The statistics used in this section and the general approach to simulation is based upon Pyndick and Rubinfeld (1986) and Challen and Hagger (1983).
2. This is less than a pure test of the system's outside tracking performance, since the data which is made available by re-estimating over a short period will have influenced the specification of the system.
3. For a thorough review of alternative estimation methods in the context of macro econometric modelling, see Challen and Hagger (1983).
4. Thailand, for instance, uses the former procedure and Malaysia the latter.
5. Since we used required reserves in level rather than in ratio form, we computed the equivalent percentage increase in RR associated with a 2.5 per cent increase in the RR ratio for the first period. This was done to facilitate comparison with the SEACEN country studies.

Actual and Simulated Compared

FIGURE 1

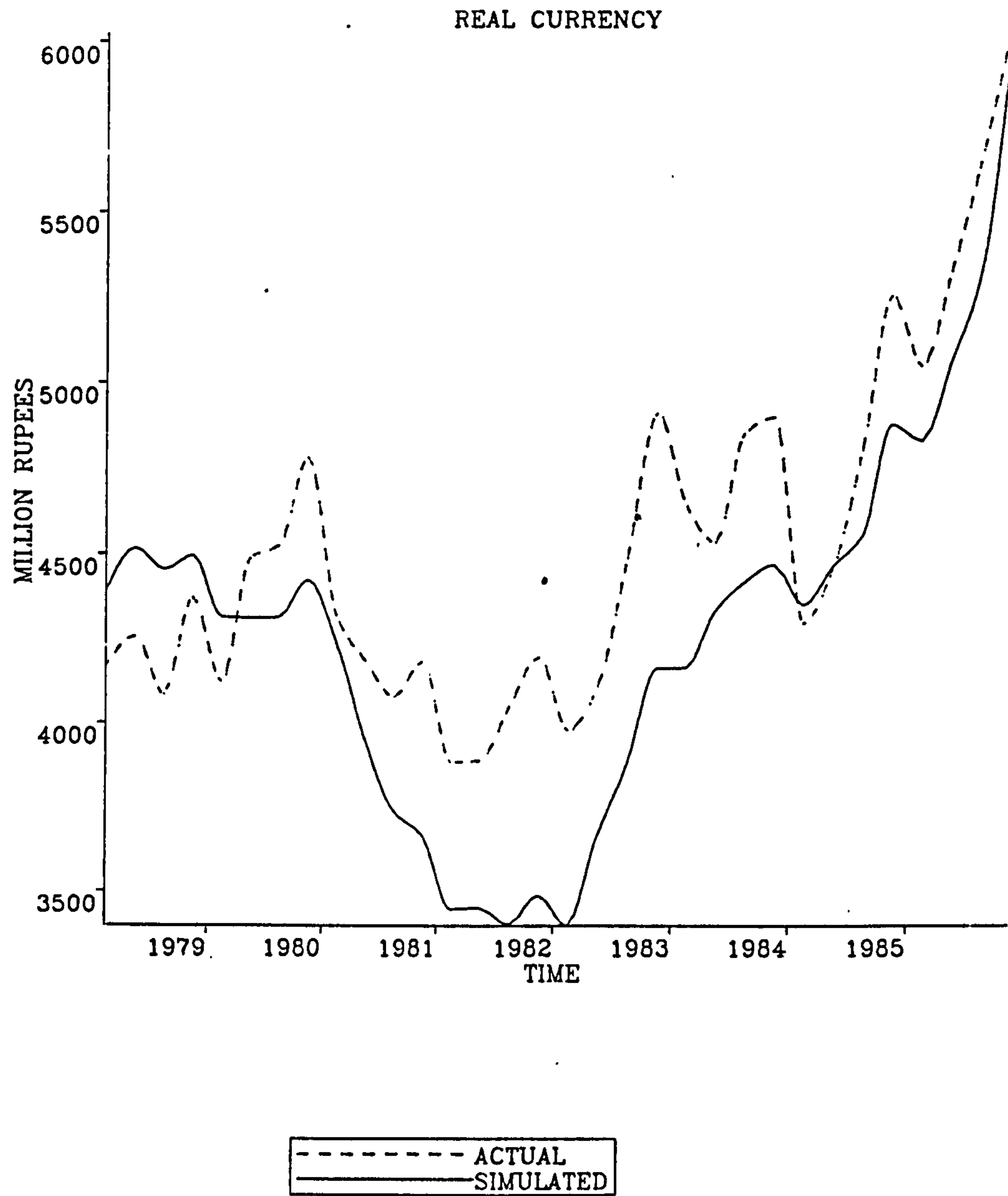


FIGURE 2

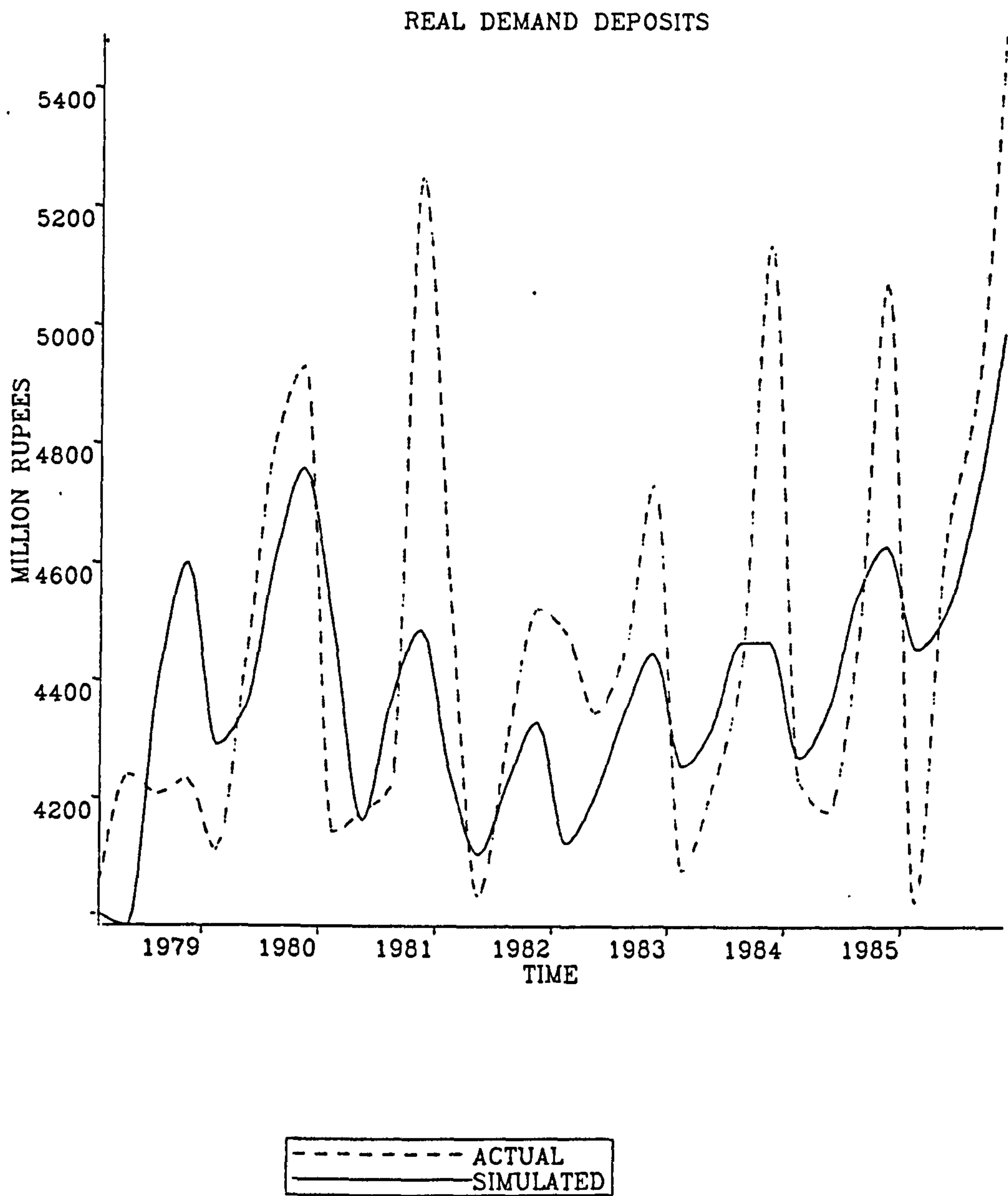


FIGURE 3

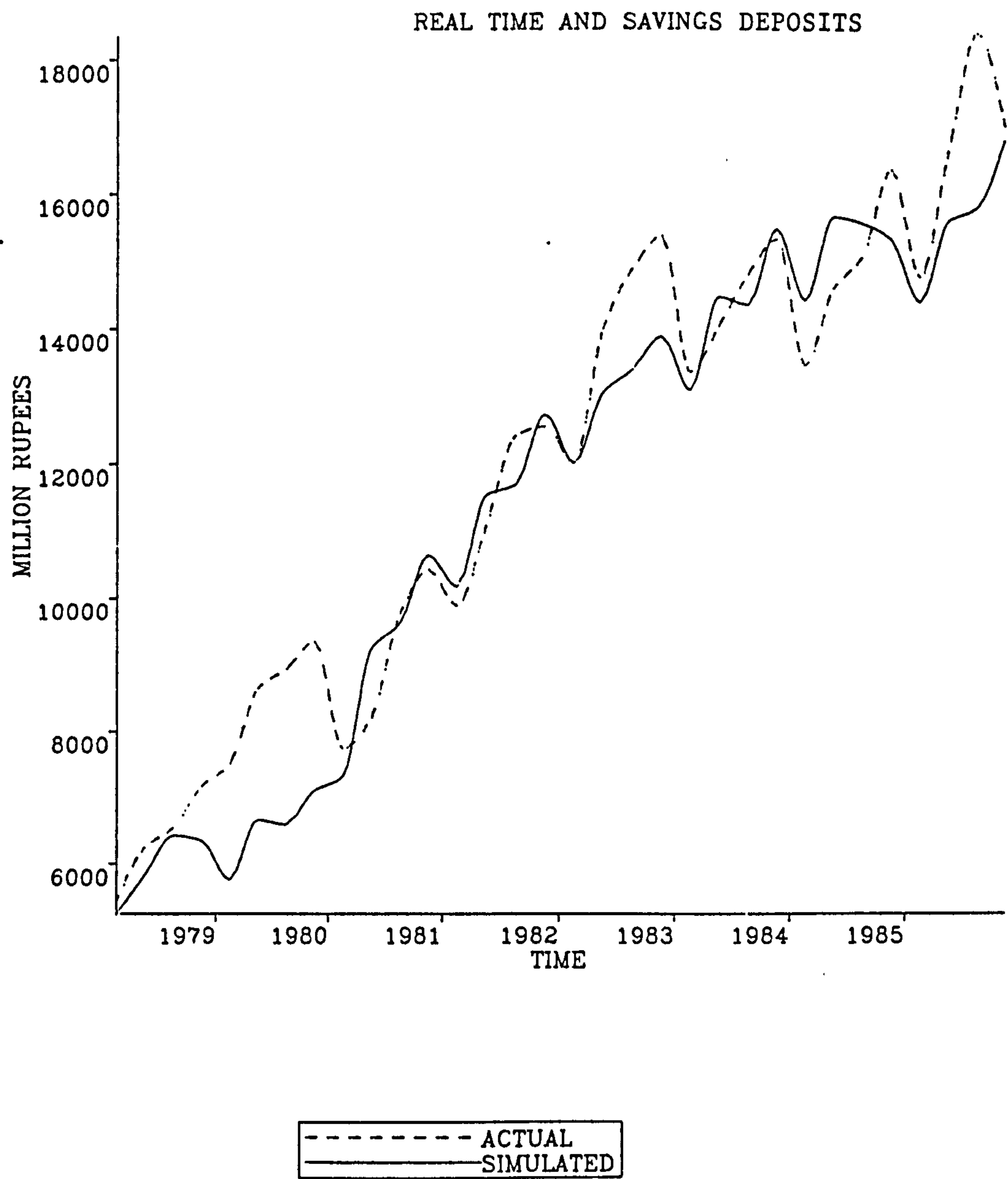


FIGURE 4

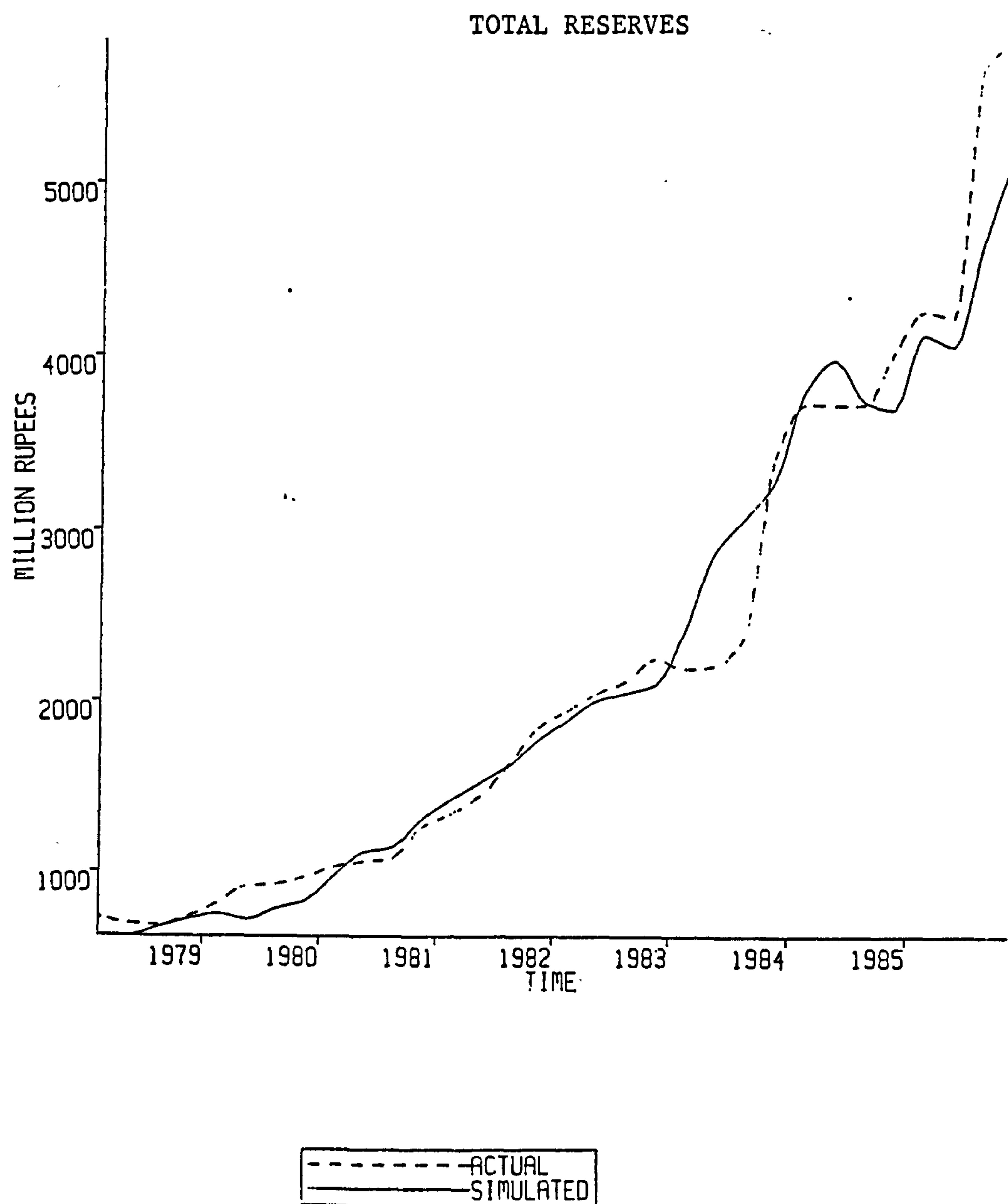


FIGURE 5

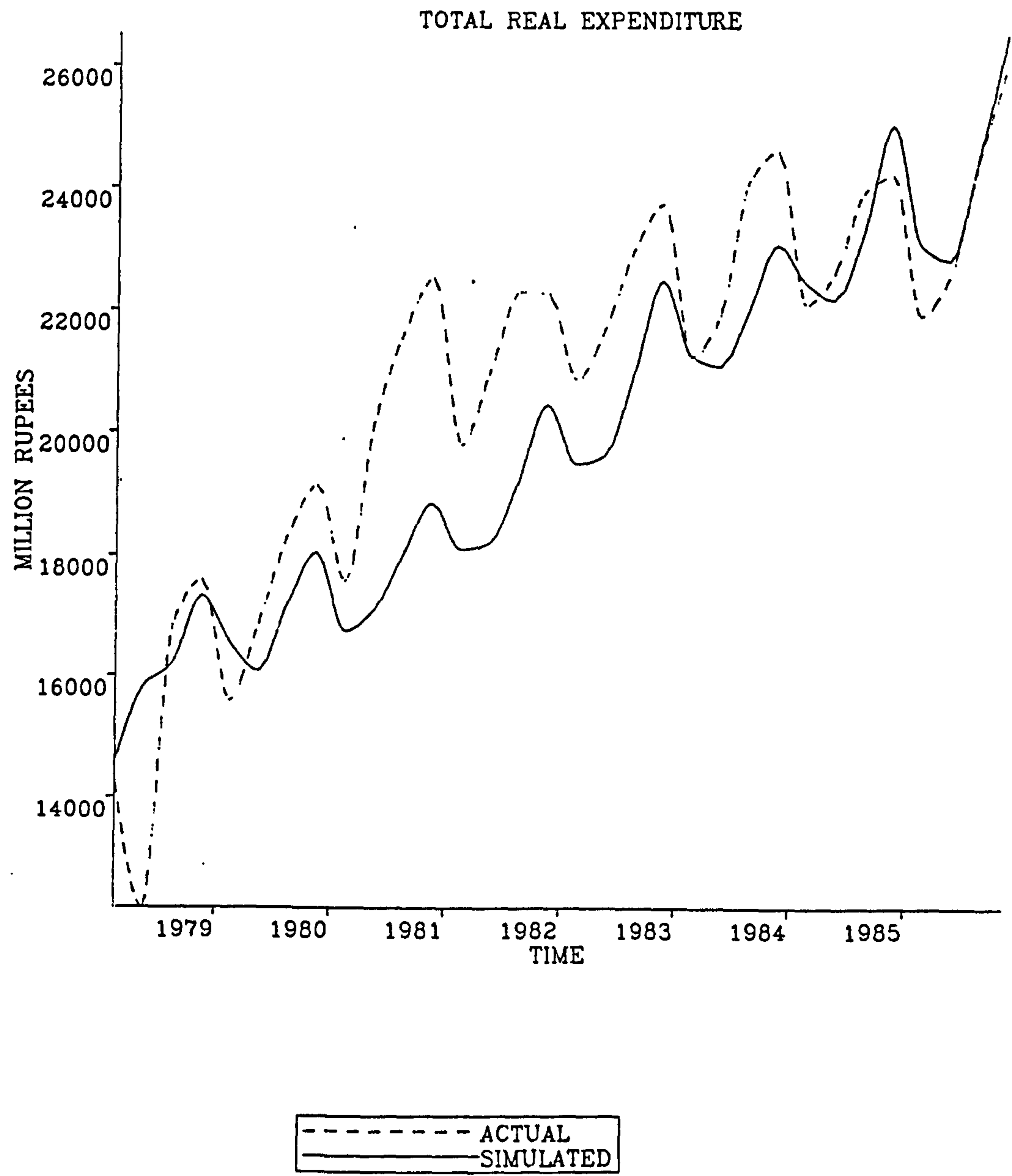


FIGURE 6

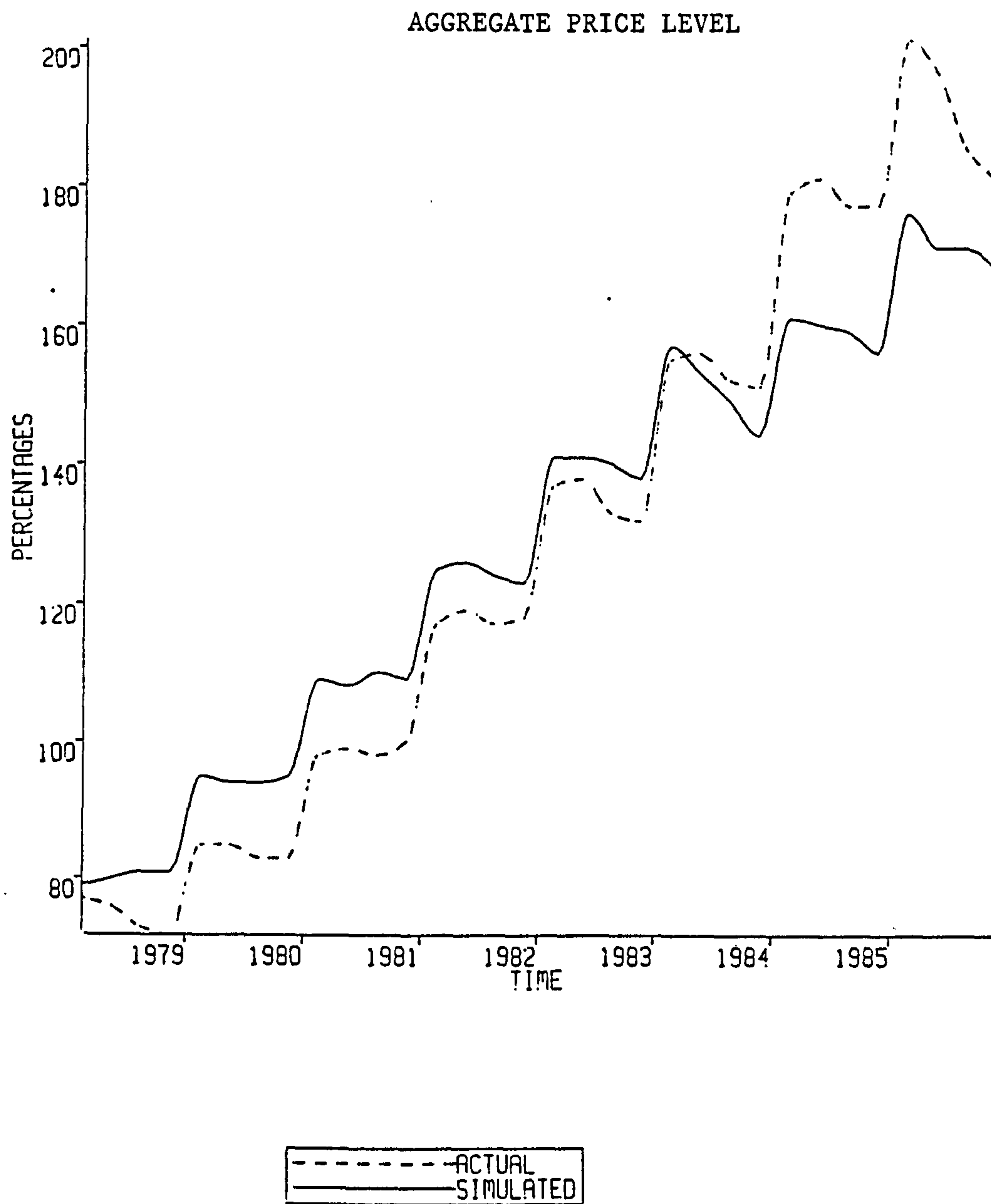


FIGURE 7

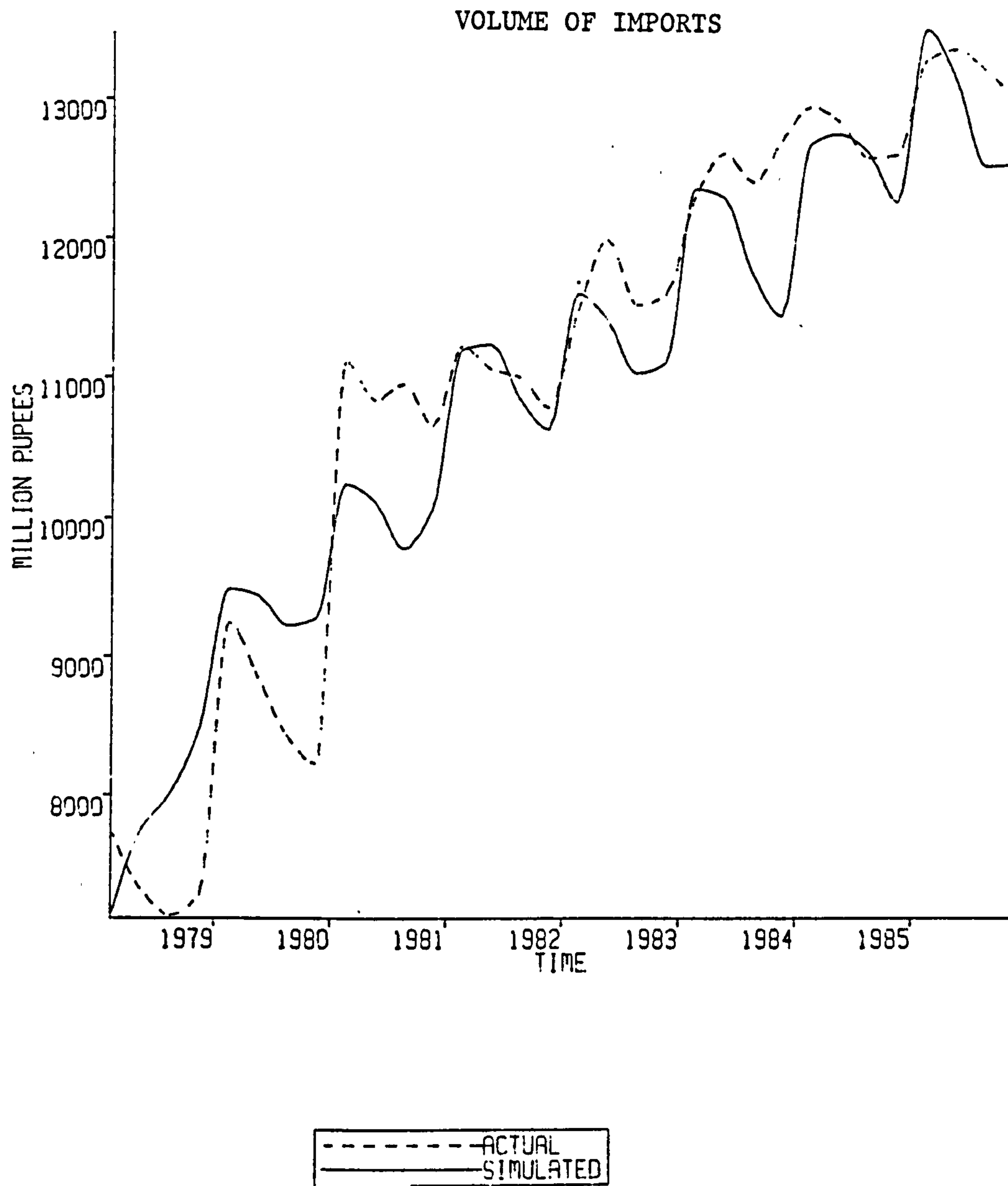


FIGURE 8

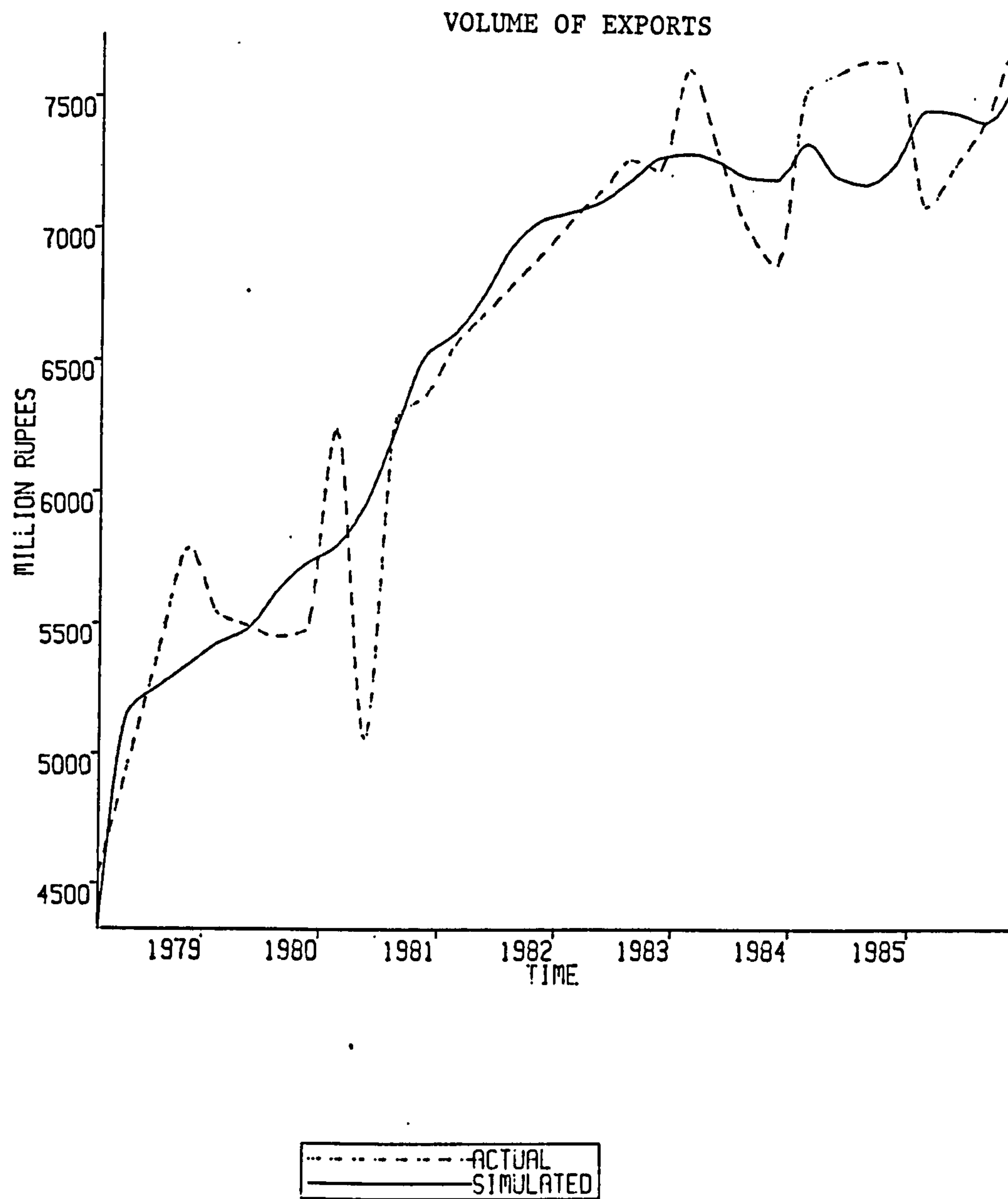


FIGURE 9

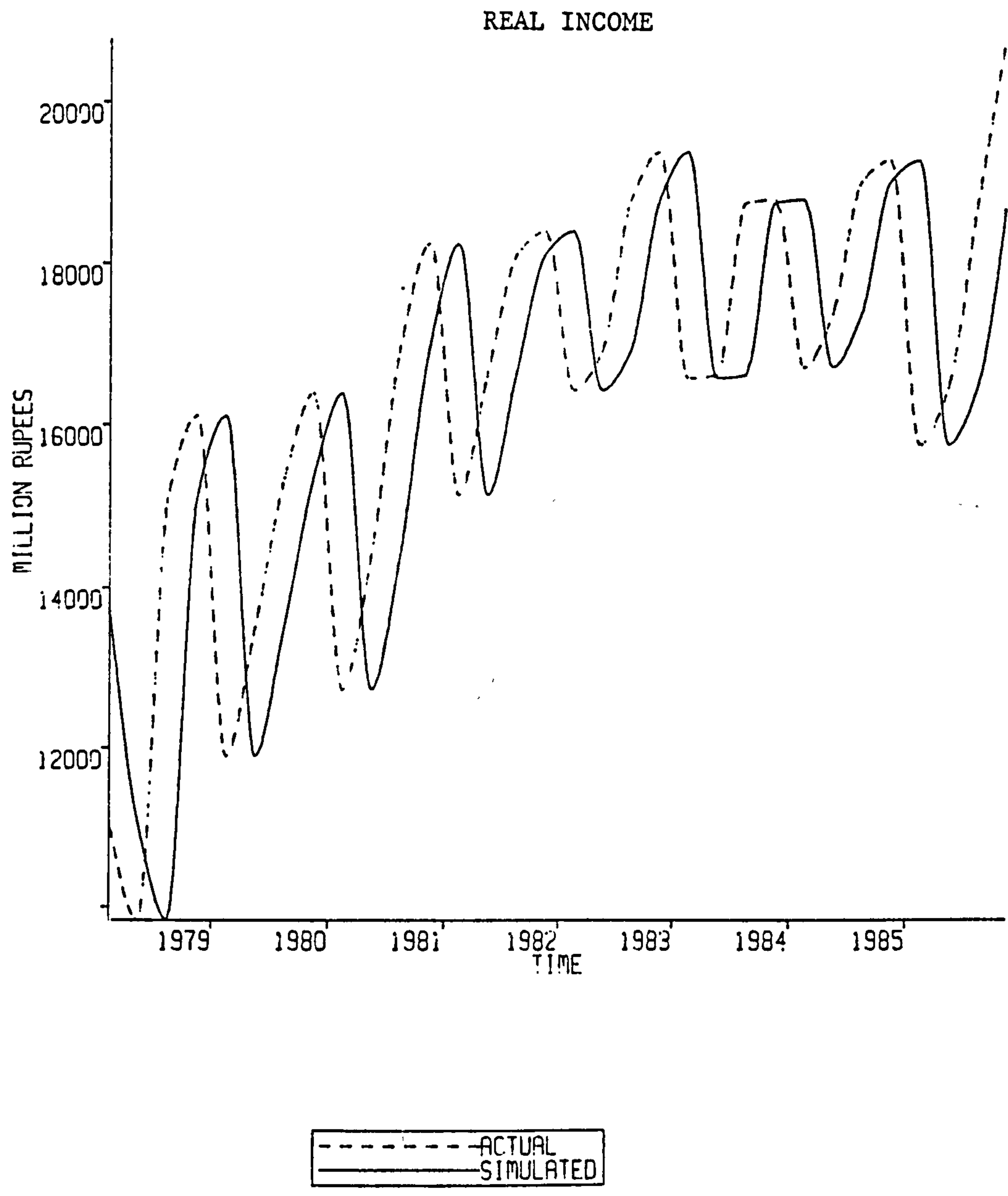


FIGURE 10

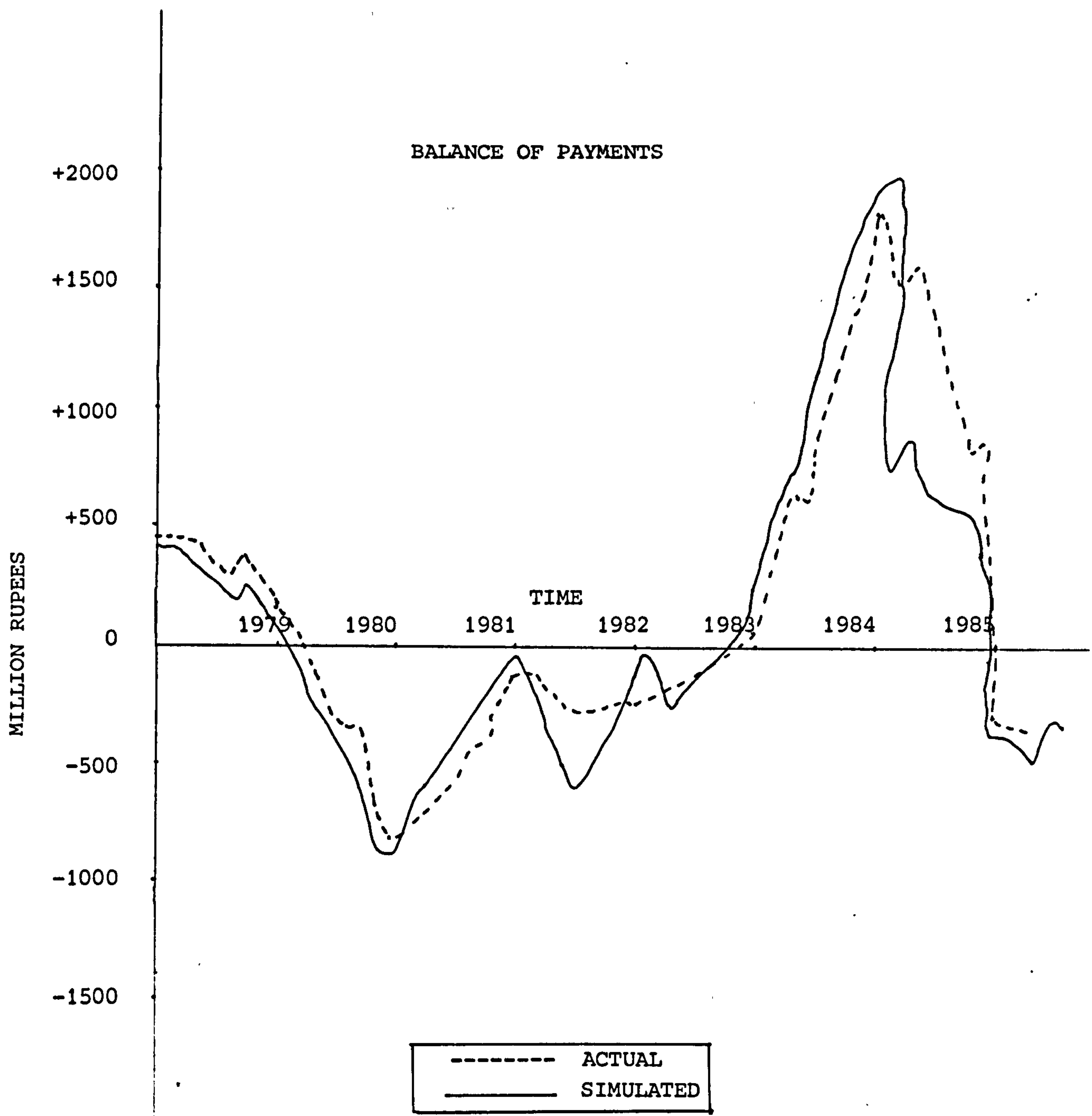


FIGURE 11

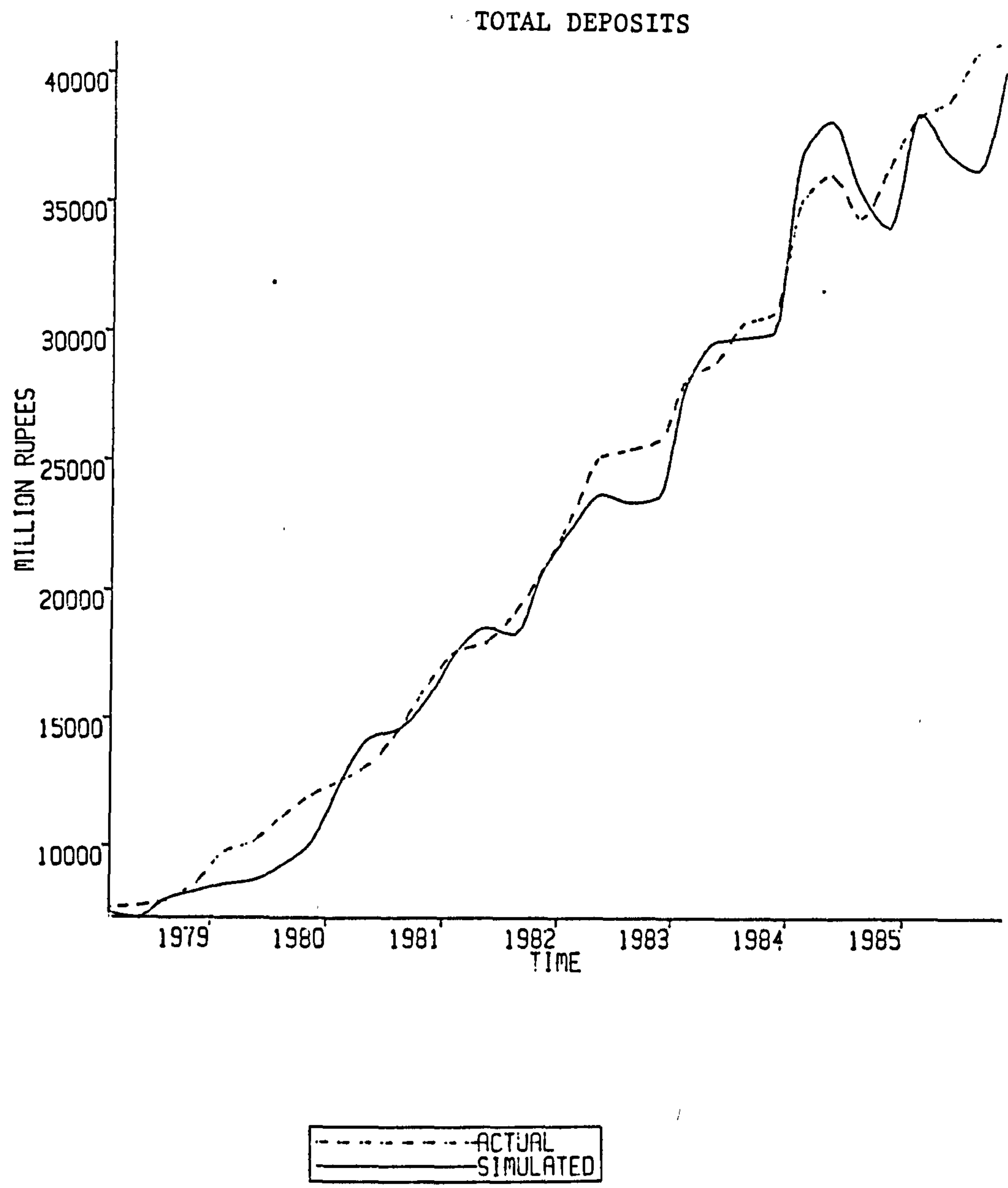


FIGURE 12

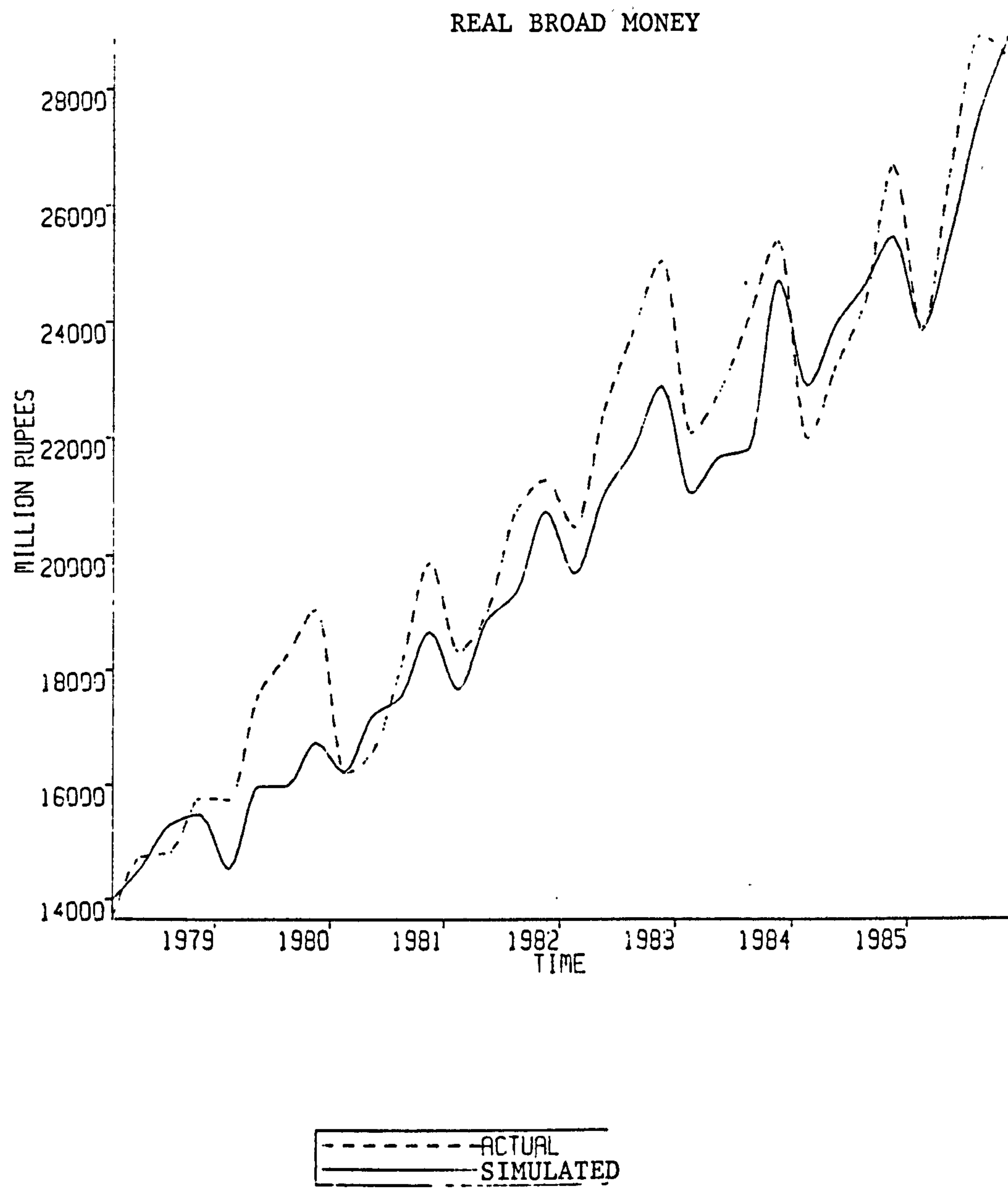


FIGURE 13

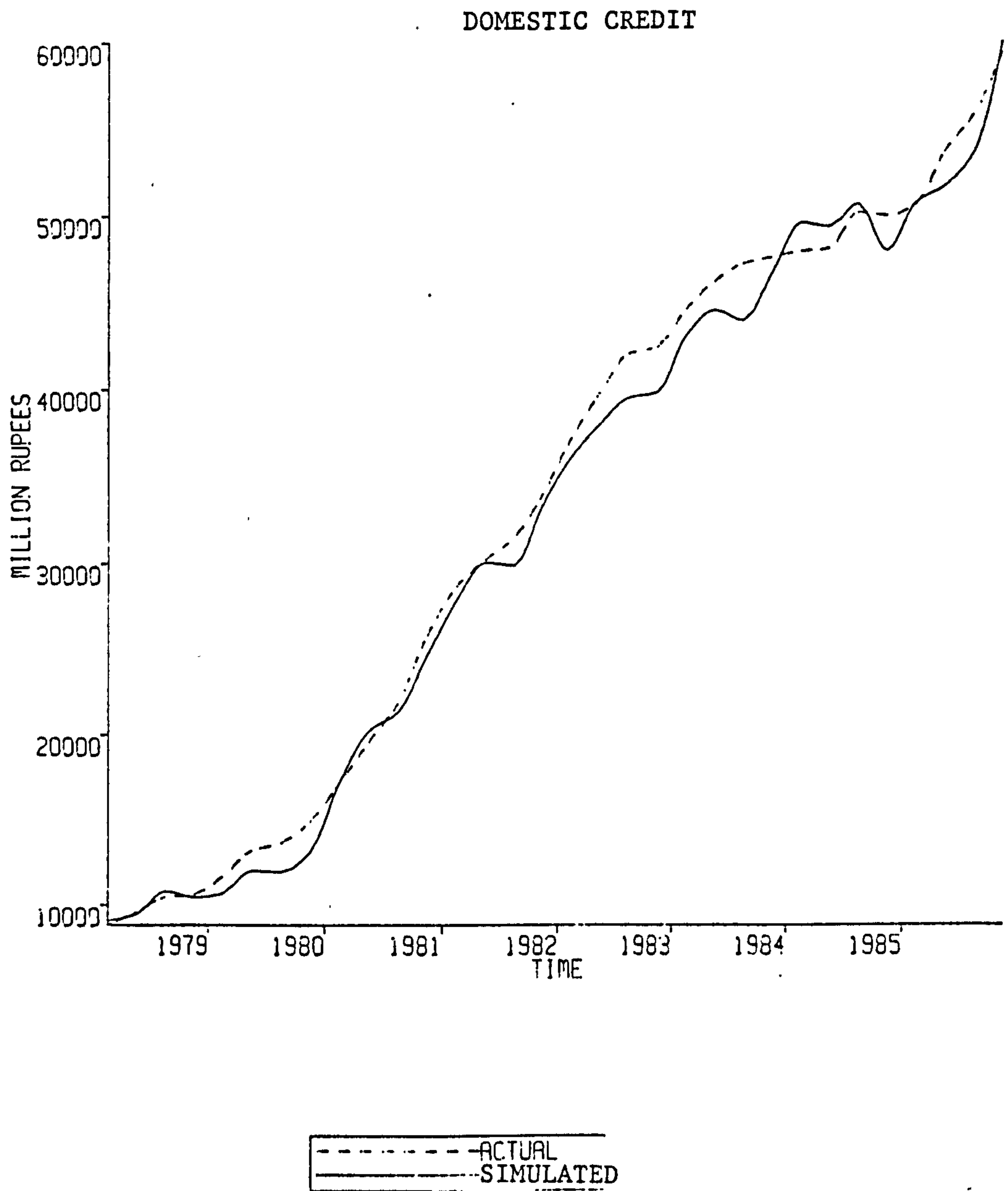
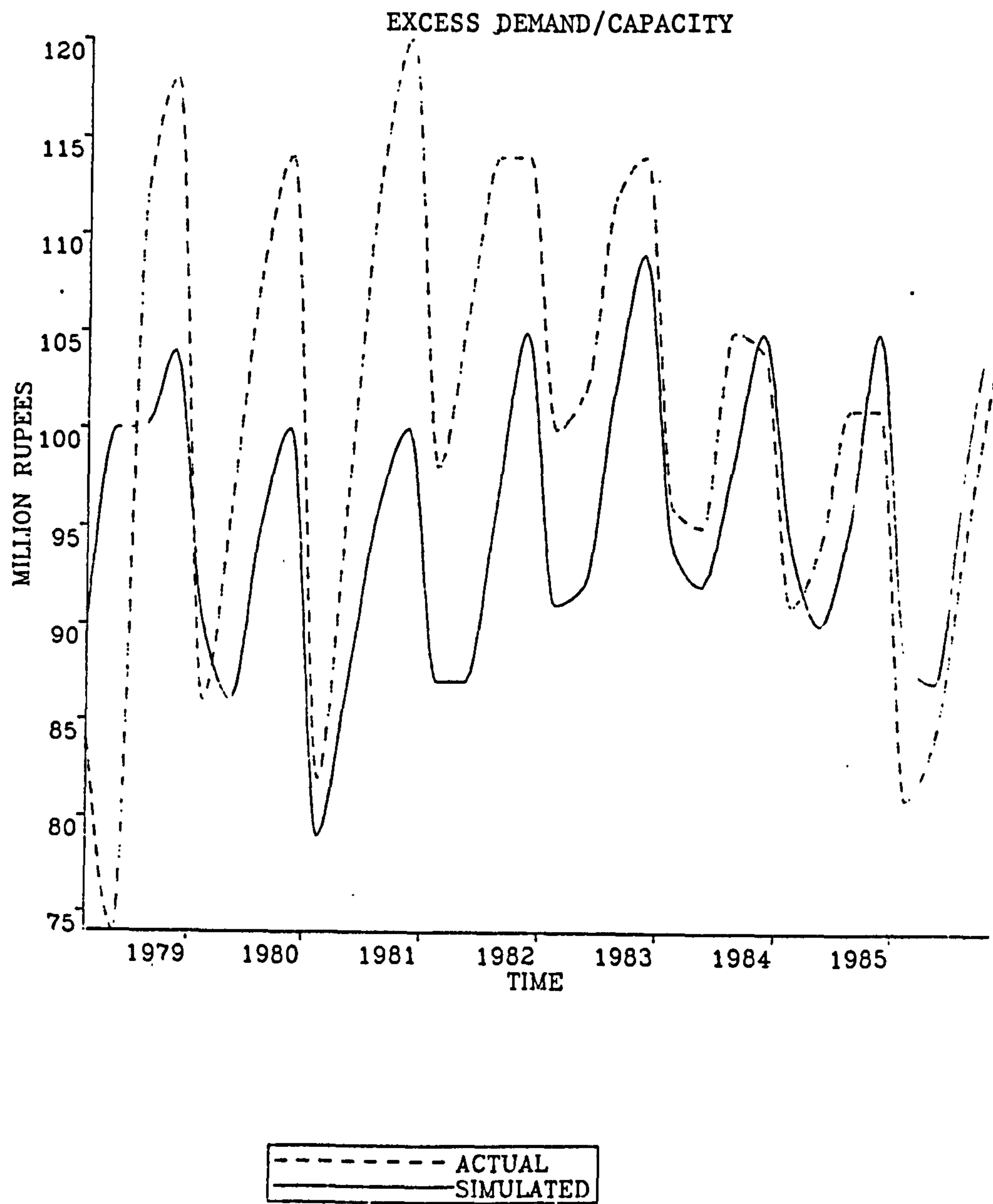


FIGURE 14



Actual and Benchmark Compared

FIGURE 15

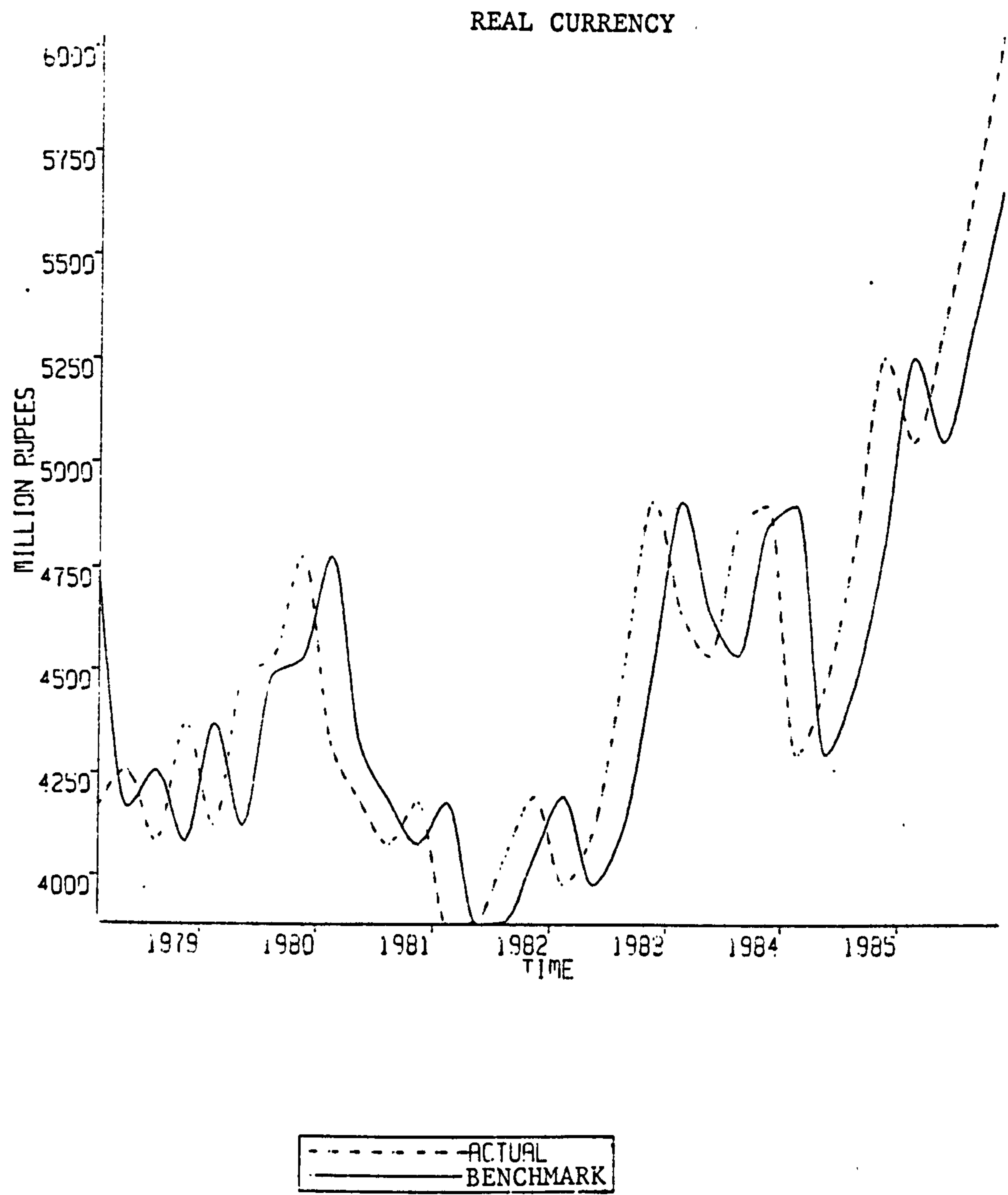


FIGURE 16

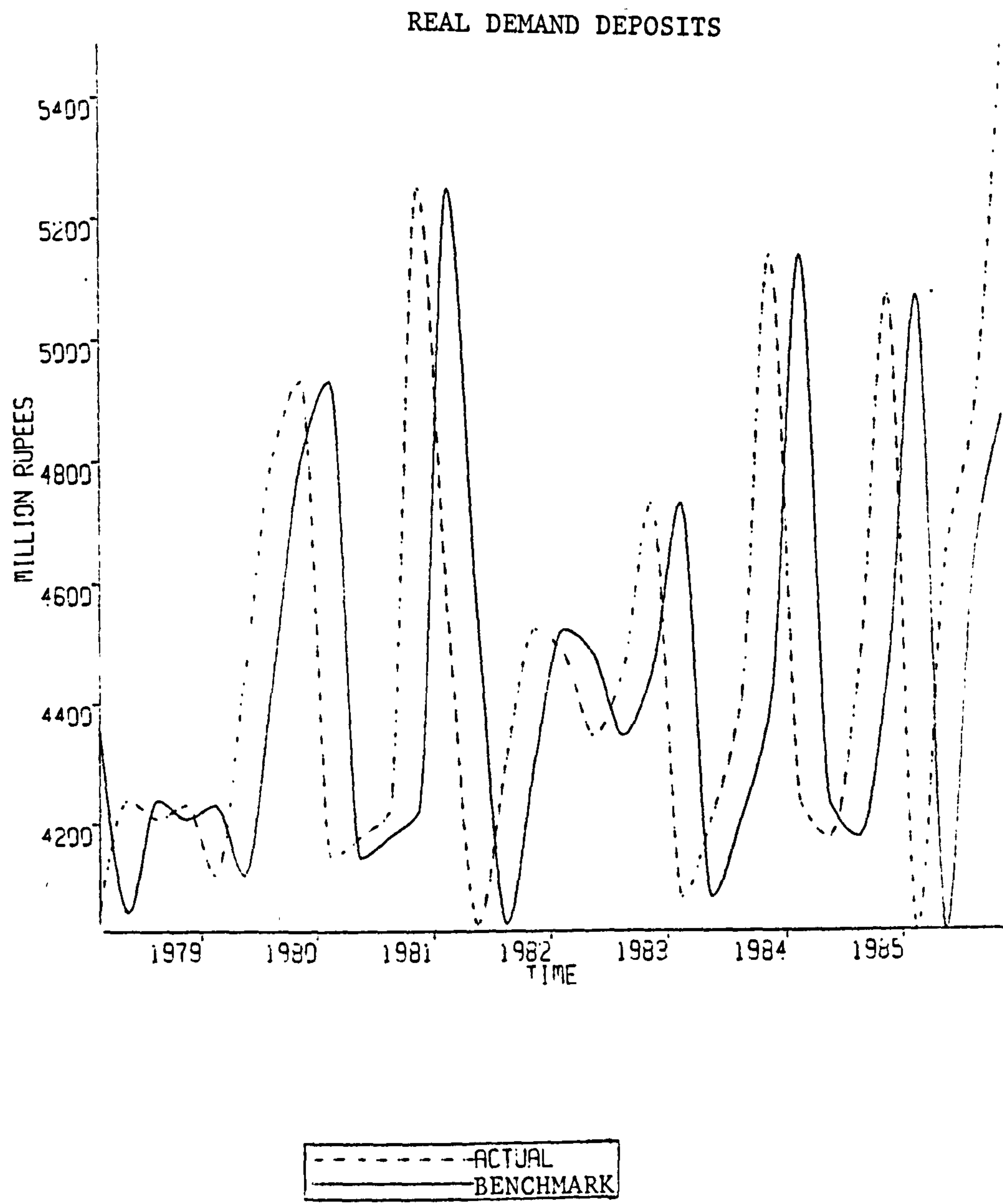


FIGURE 17

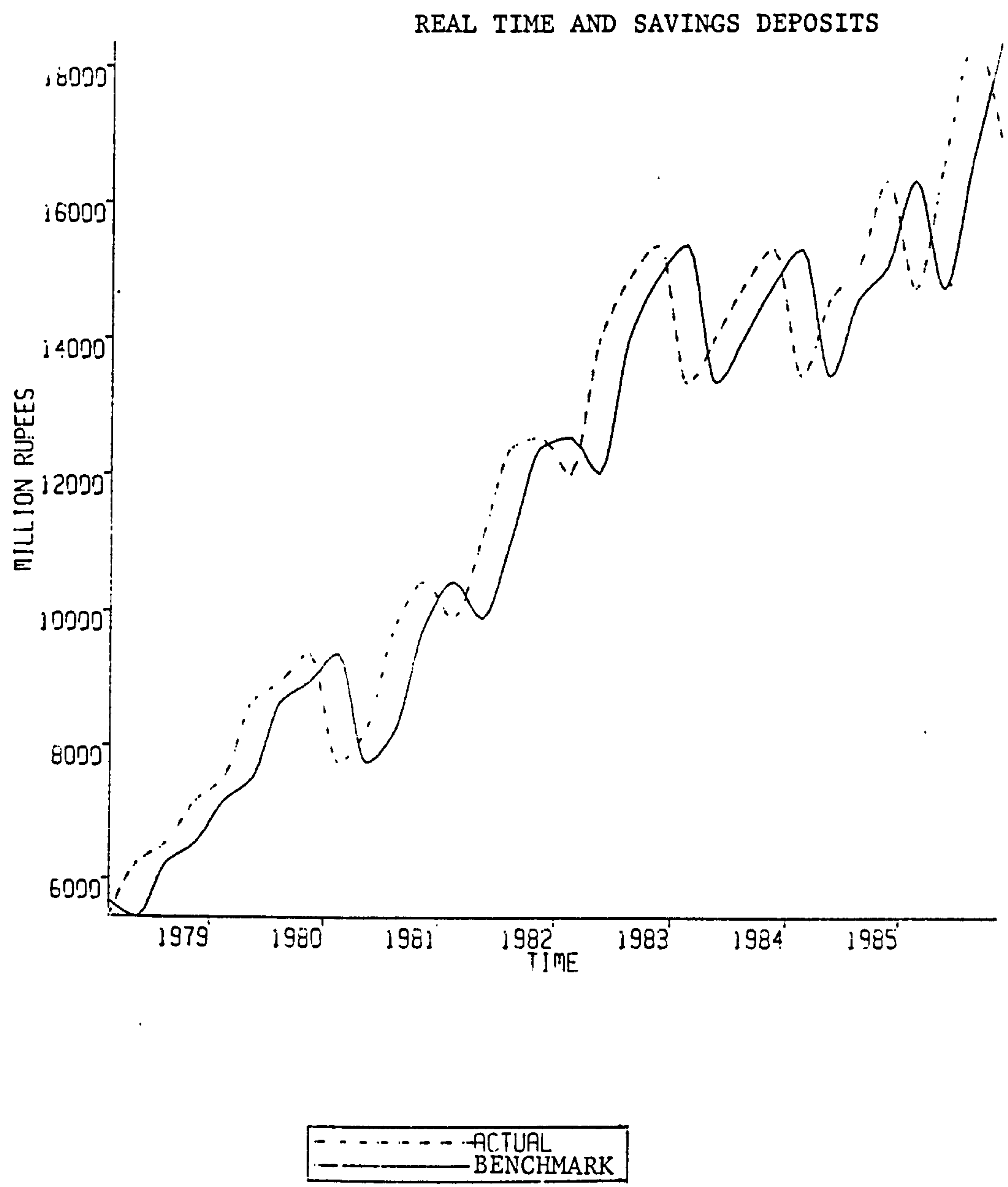


FIGURE 18

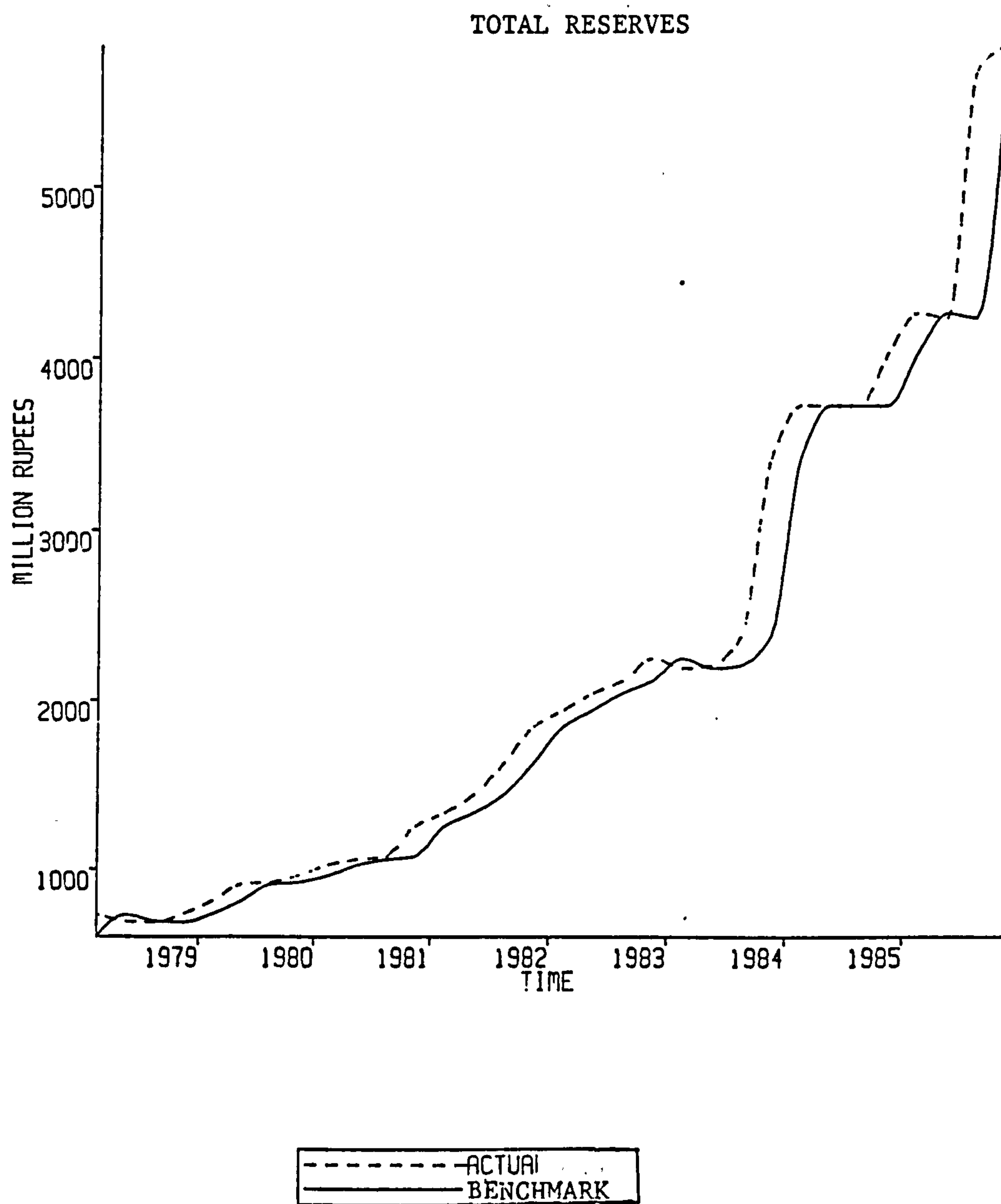


FIGURE 19

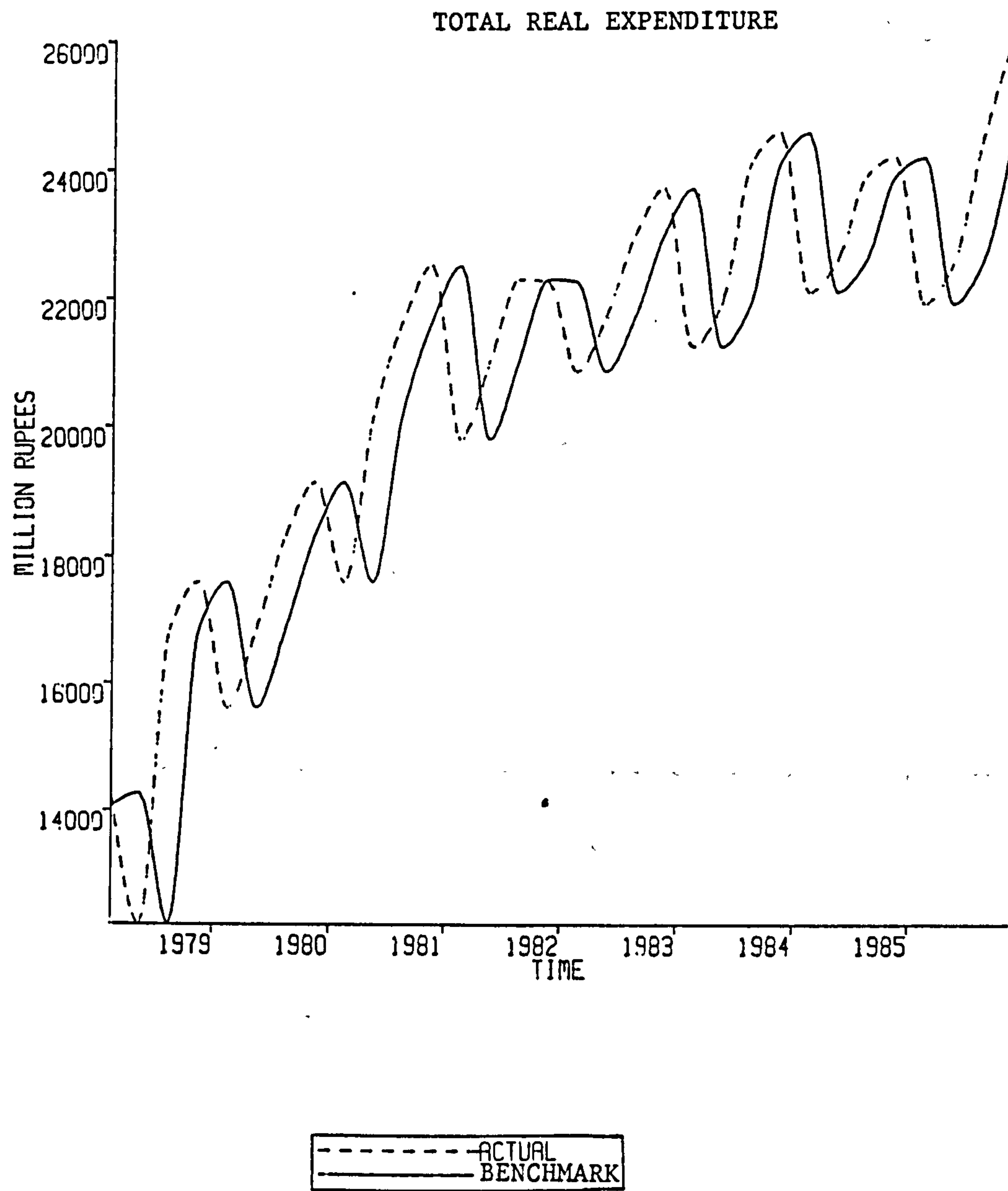


FIGURE 20

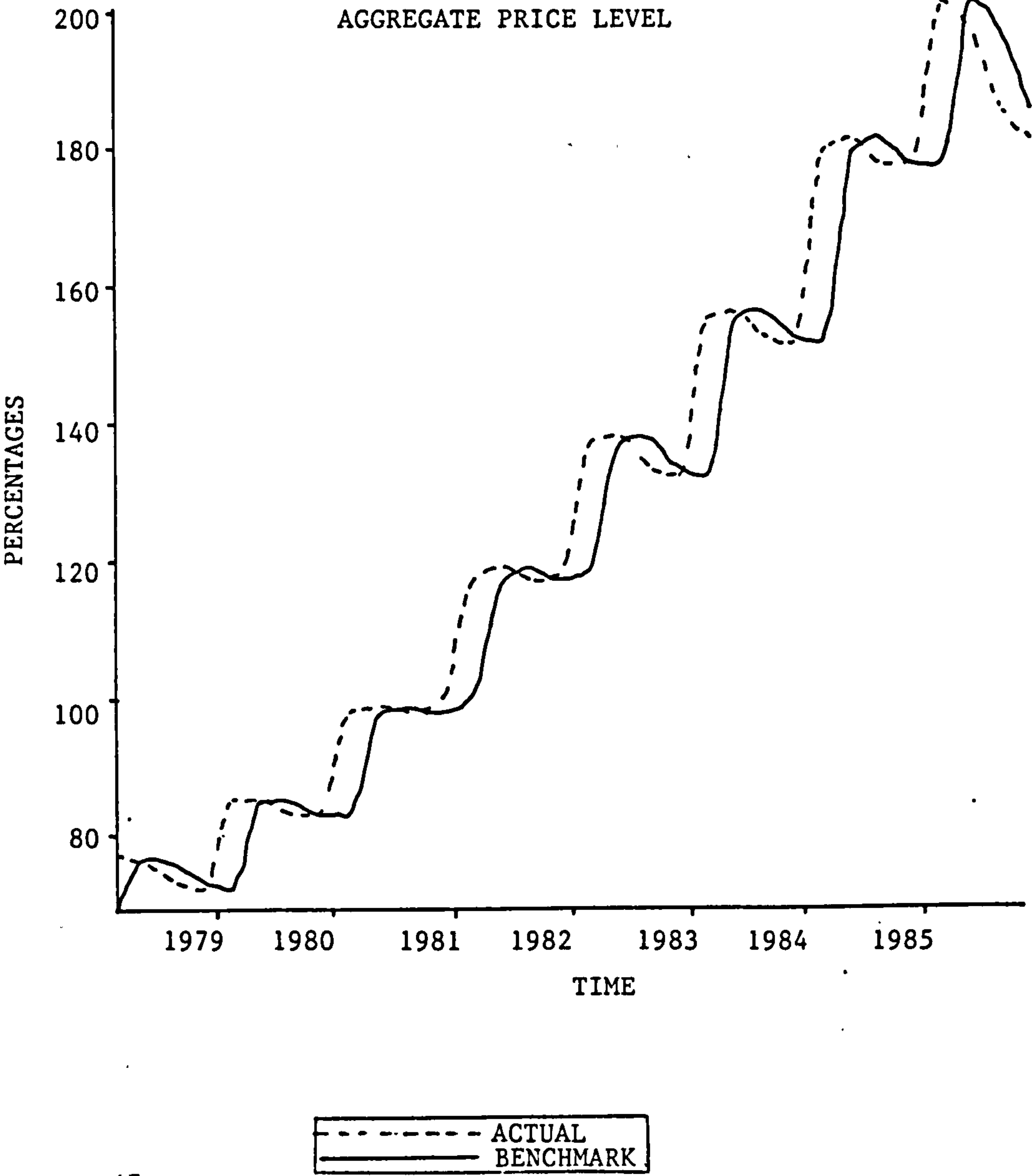


FIGURE 21

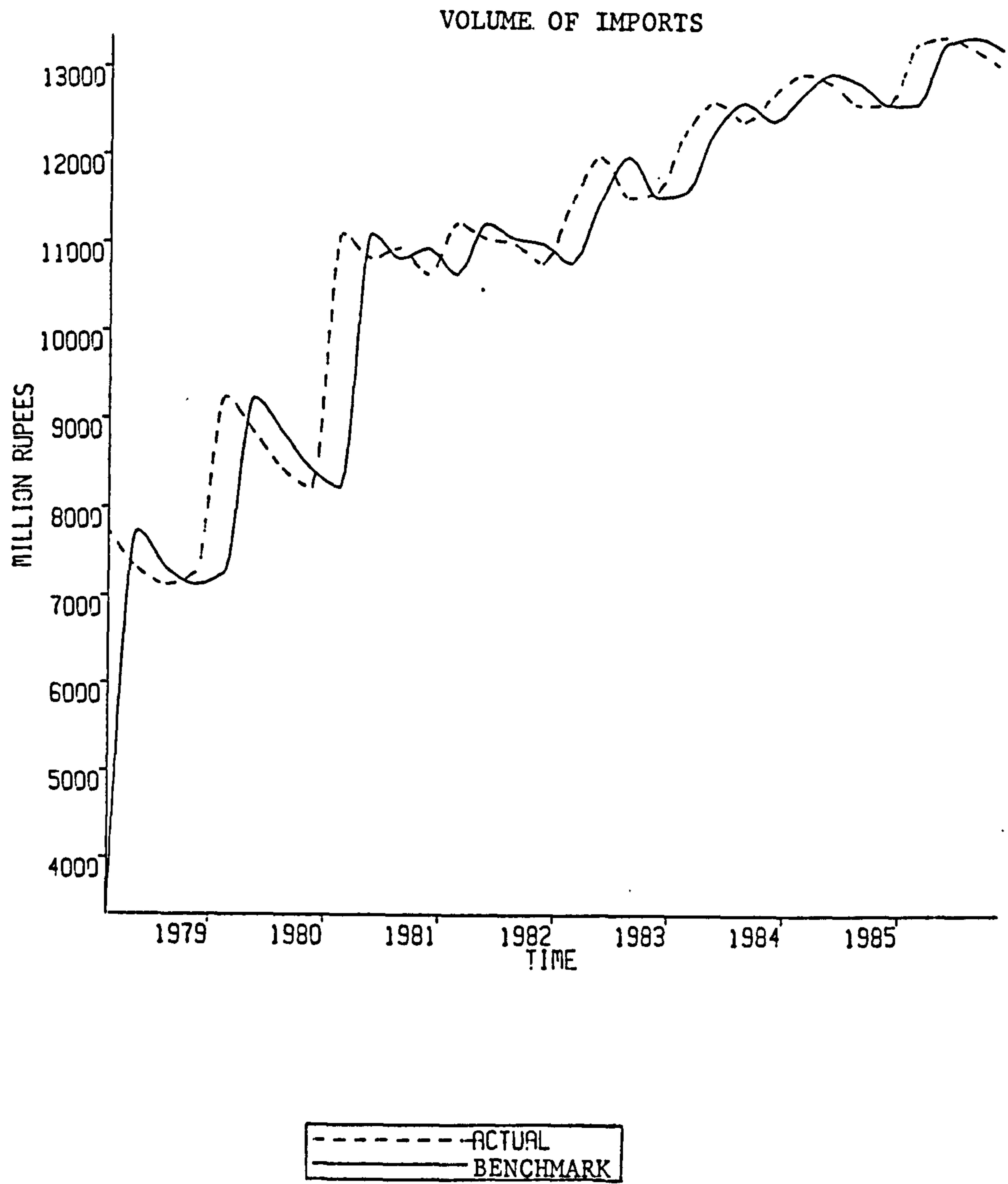


FIGURE 22

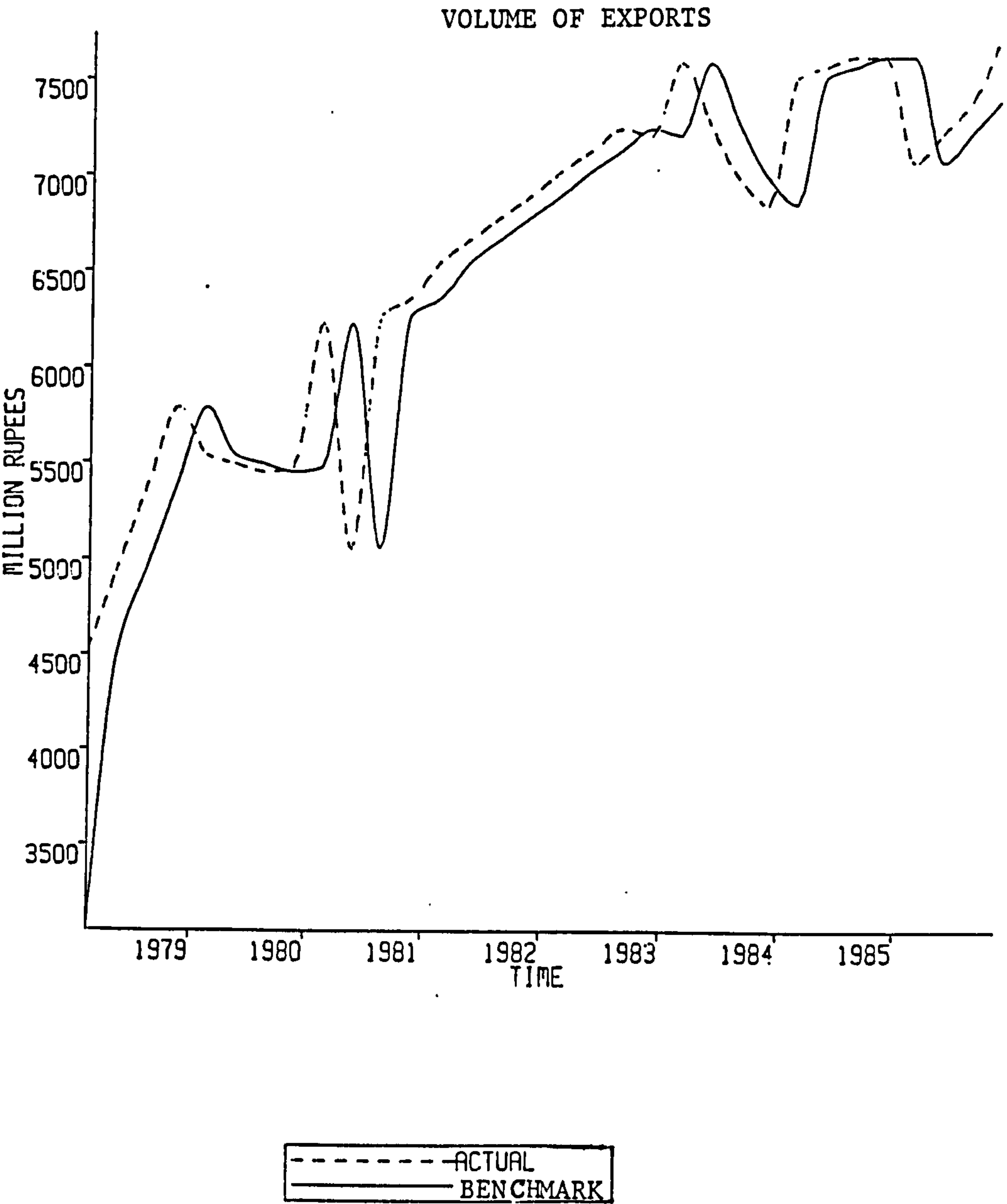


FIGURE 23

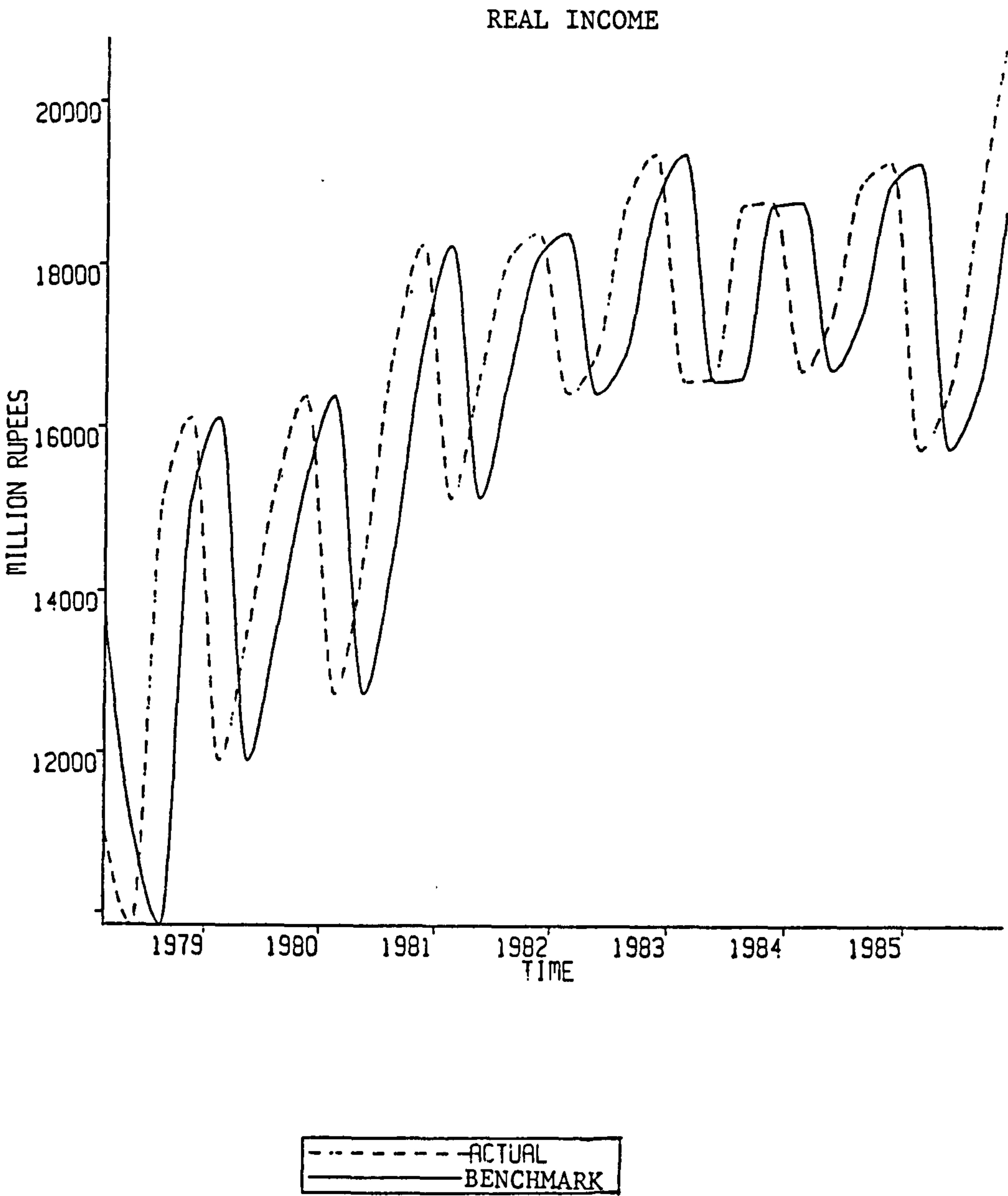


FIGURE 24

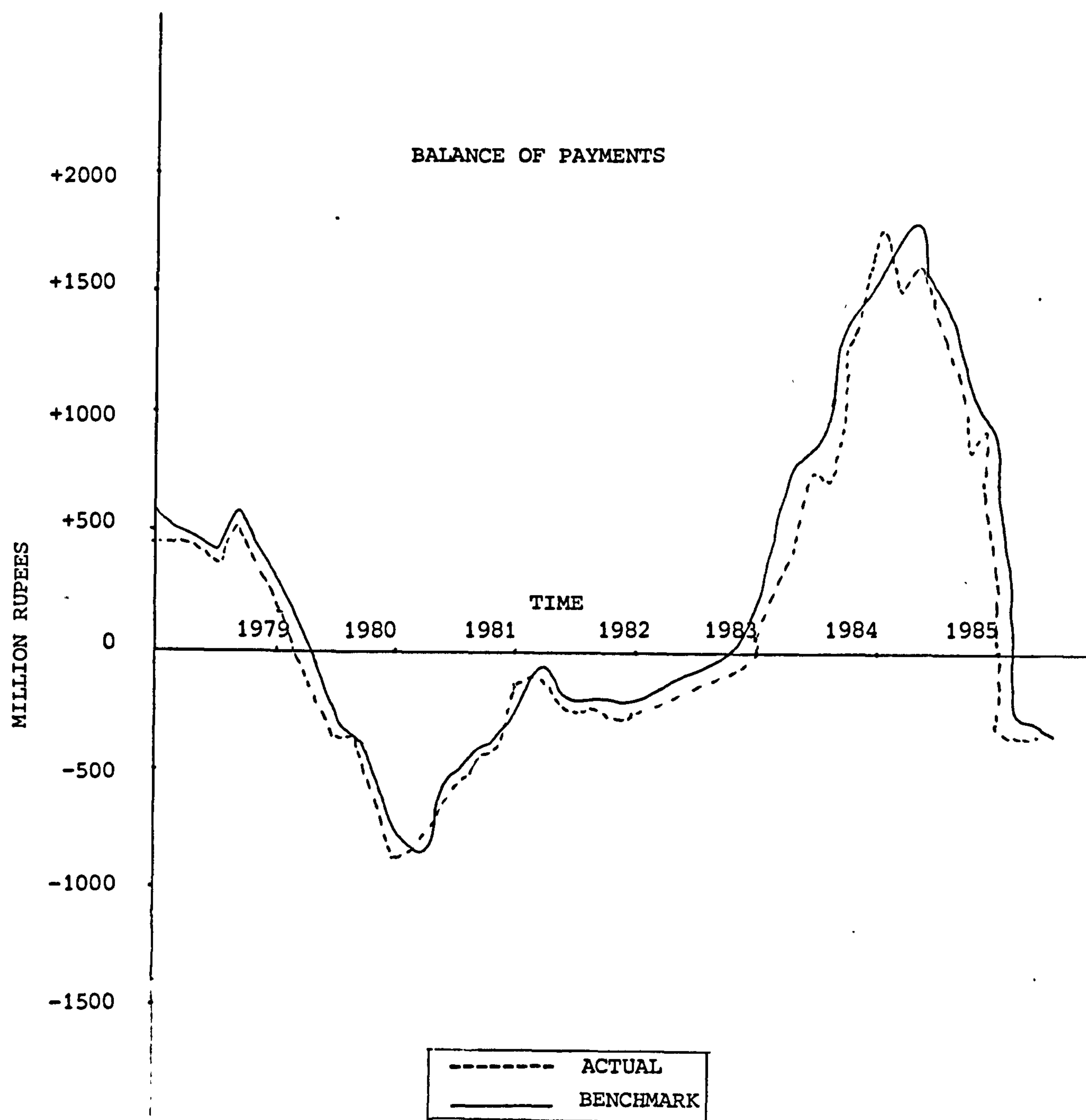


FIGURE 25

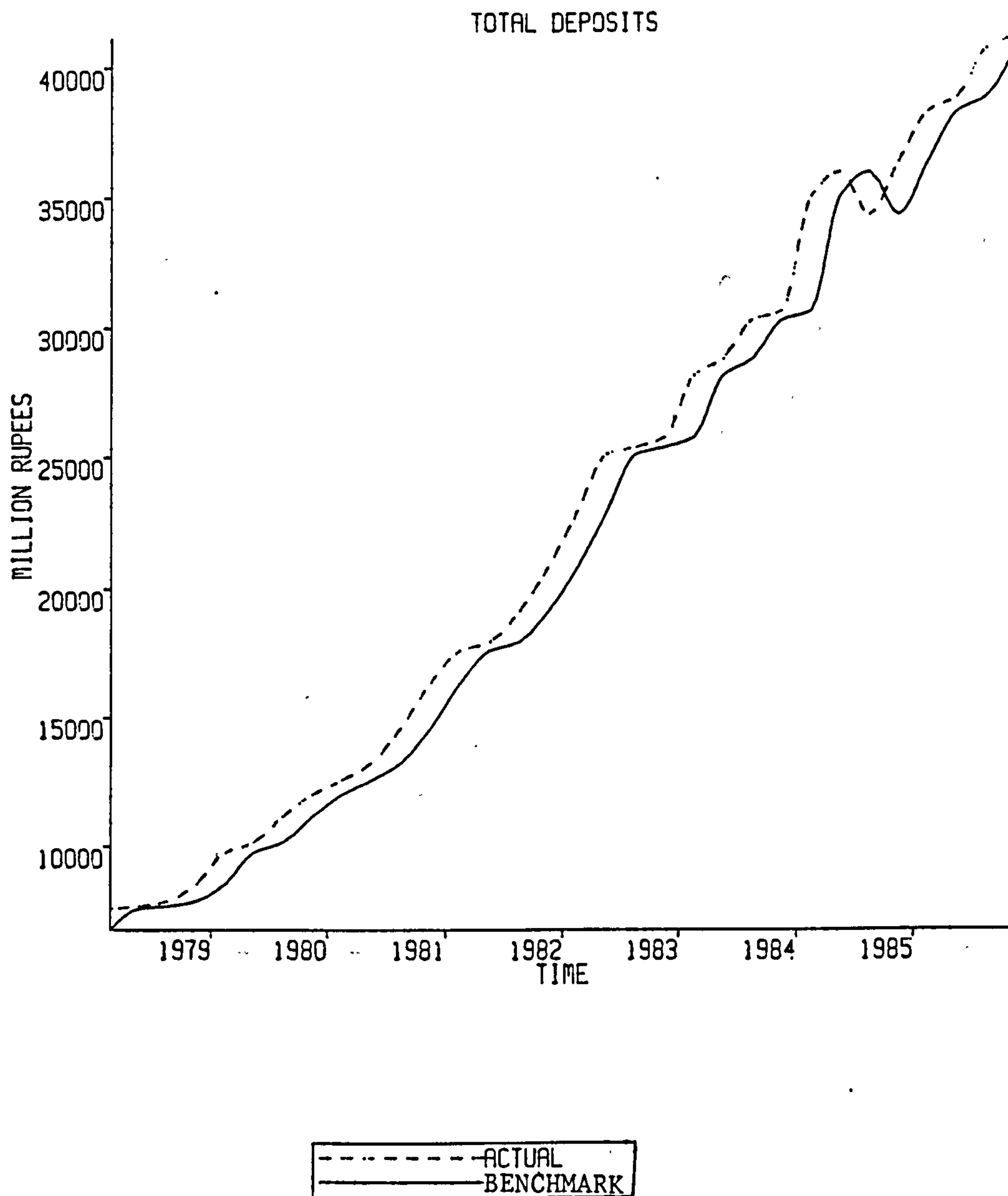


FIGURE 26

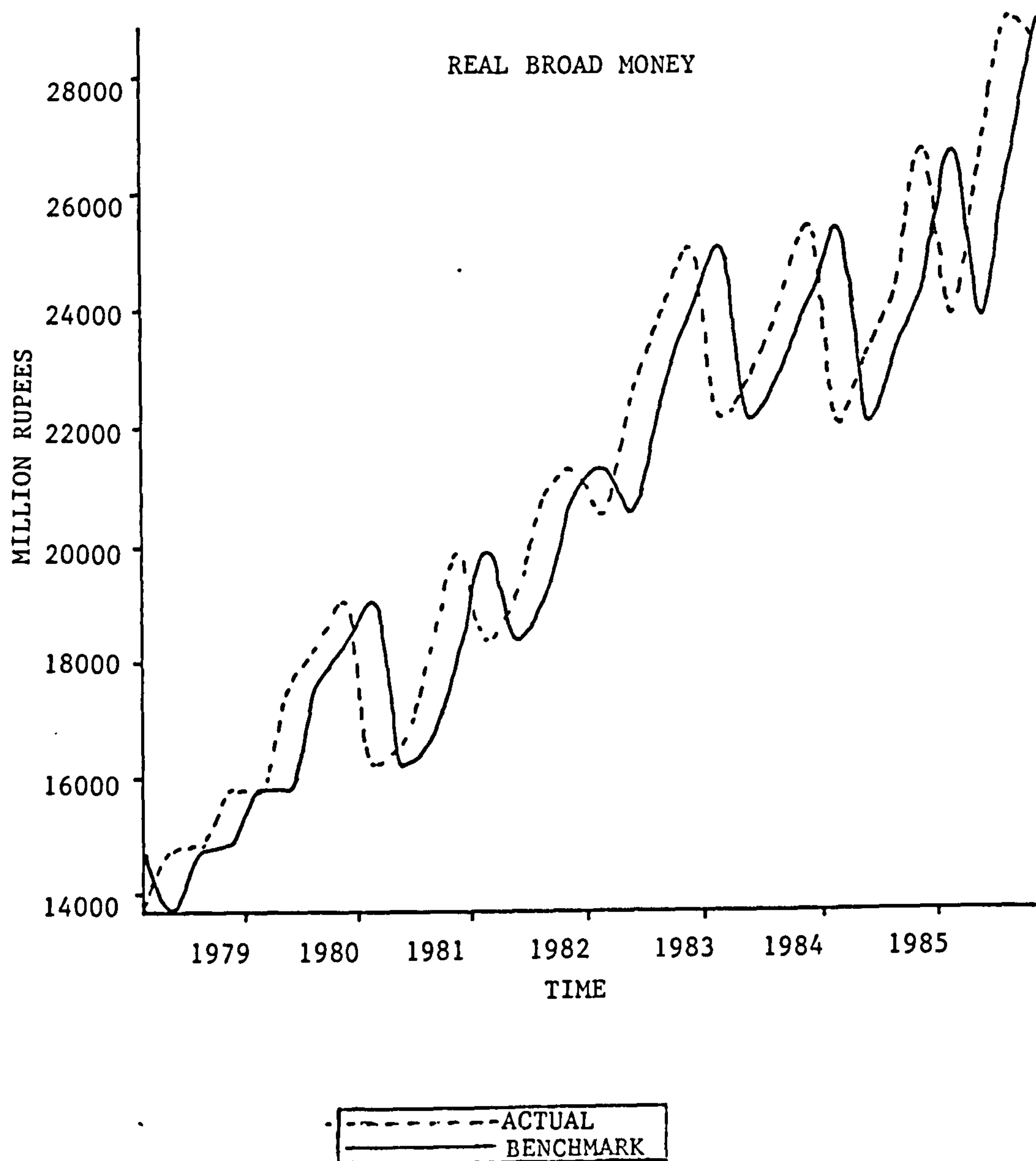


FIGURE 27

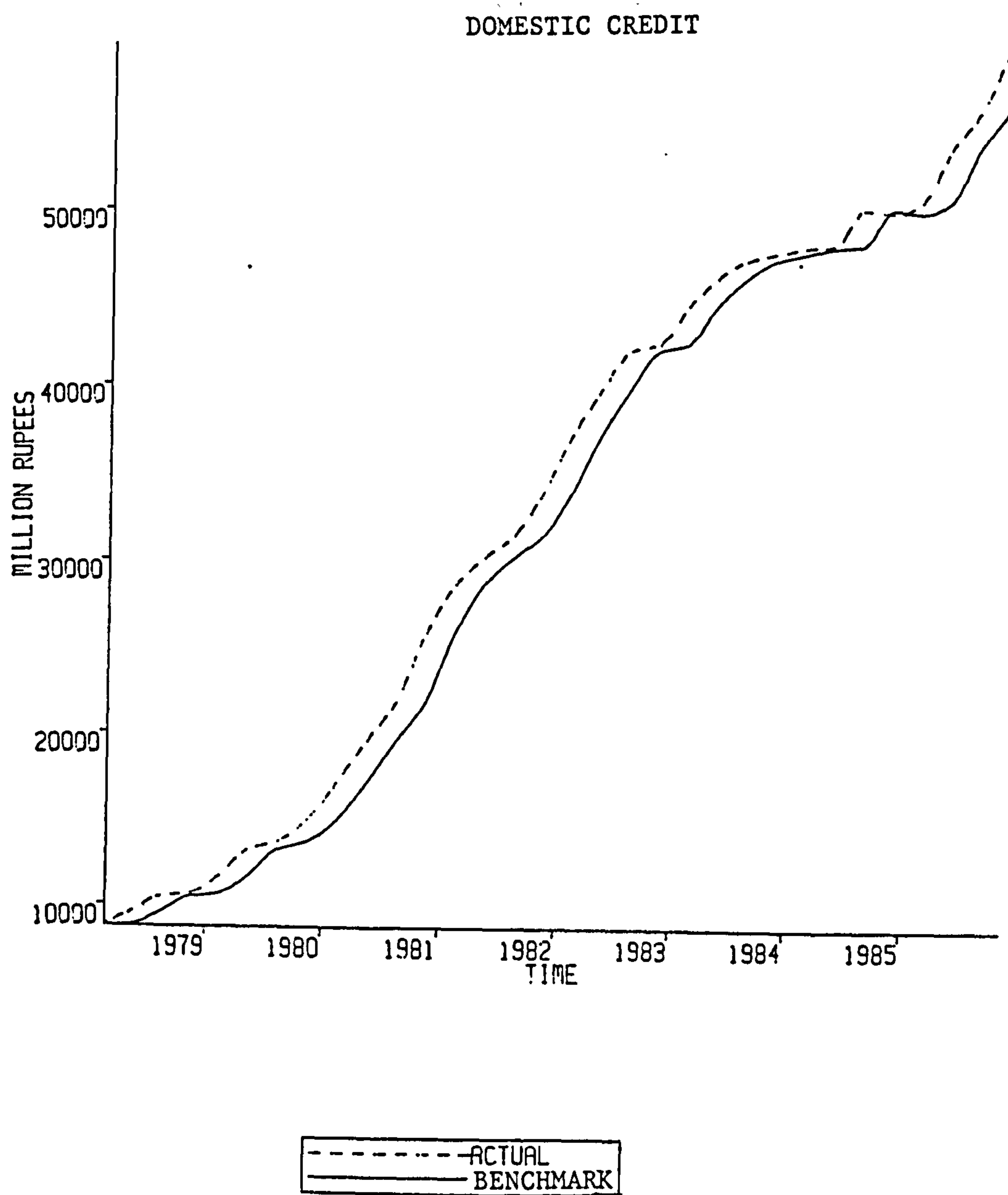
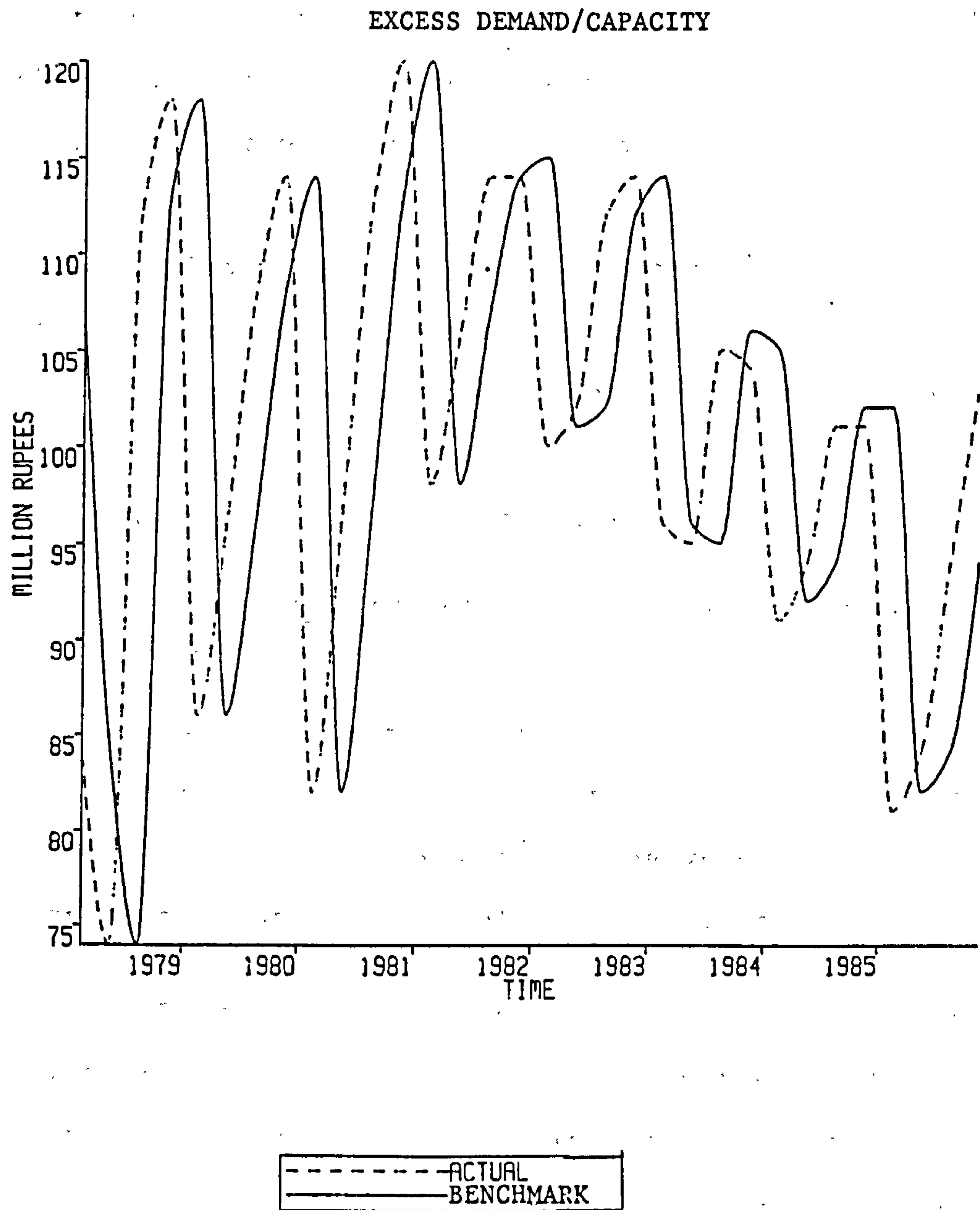


FIGURE 28



CHAPTER 6

THE IDENTIFICATION OF THE MONETARY TRANSMISSION CHANNELS

This chapter aims to identify the important MTCs in Sri Lanka during the period 1977-1985. This is necessary prior to the discussion of policy options and the formulation of the monetary control framework (MCF) in the next chapter. Section 6.1 deals with the criteria for identification i.e. the analysis of the historical behaviour of the major MTCs in Sri Lanka and examines their effectiveness in transmitting monetary impulses to the real sector. We then compare this with the results obtained from the empirical model and simulation experiments in chapters 4 and 5 respectively. 6.2 analyses the relative importance of these MTCs and our conclusions are presented in 6.3.

6.1 Criteria For Identification of the Monetary Transmission Channels

We deal first with the general problems relating to the identification of the Monetary Transmission Mechanism (MTM) and follow this with an analysis of the effectiveness of each of the channels in particular.

Firstly, the working of the MTM is complex and asymmetrical. For example, a rise in the level of employment following expansionary monetary and fiscal policies based on over-optimistic growth prospects will feed quickly into higher inflation. On the other hand, restrictive monetary and fiscal policies might reduce inflation but

output and growth would be adversely affected. Similarly, if a recession induced public sector deficit overshoots, holding to monetary targets may lead to a rise in real interest rates which would not be appropriate for a depressed situation. There can also be situations in which money growth is excessive (well above targets) along with rising real interest rates, a feature observed in Sri Lanka during 1977-1985. Therefore, both the identification of the transmission channels and the initiation of appropriate policy measures to ensure that the system works along the desired transmission paths are difficult to achieve.

Secondly, the limited range of financial assets constrains the workings of the MTM and makes its identification more difficult. Although the financial assets/GDP ratio (40 per cent at end 1985) has been impressive for Sri Lanka, it is still low compared to many DCs, such as the UK, USA and European countries. This also implies that the currency component is still a major form of transactions. The demand for currency depends on income, the expected rate of inflation, interest rates, banking services and the general uncertainty in the economy.

Thirdly, the existence of well organised ICMs adds further problems to the MTM as currency is the main mode of transactions. The higher the currency component, the lower will be the impact of monetary impulses. Although relatively small, ICMs in Sri Lanka accounted for nearly Rs 14

billion (8 per cent of GDP) at the end of 1985. See Jayamaha (1987). The linkages between ICMs and FCMs are strong and therefore, it is difficult to isolate transactions from each of them separately.

Fourthly, financial innovation (FI) also makes the MTM and its control more complex. Although FI reduces the role of non-price elements, such as CR and other direct intervention methods, it has in fact resulted in changes in the demand for money and makes monetary control more difficult. Traditionally, the practice has been to draw a dividing line somewhere in the spectrum of assets, marked according to their 'moneyness.' The FI has made the dividing line between money and the other financial assets conceptually more arbitrary and practically more difficult. When FI proceeds rapidly, the appropriate concept will be subject to change requiring the periodic re-definition of money. For details see Jayamaha (1985). For example, Sri Lanka used M1 for monetary control purposes from the inception of the Central Bank (CB) in 1950. This was changed to broad money in 1980 to include quasi-money and since then both narrow money (M1) and broad money (M2) and have been used for monetary targeting purposes. It has now been found that even M2 is not comprehensive as NSB and FC deposits are outside M2 and they have grown rapidly over the last several years. The Financial Survey (as at end 1985) presented in Table 6.1 shows that about 30 per cent of the deposits are not included in the calculation of M2 and part

Table 6.1

Financial Survey (as at the end of 1985)

(Rs. Million)															
		Commercial Banks	Finance Companies	Development Banks		Savings Institutions		Insurance Corp.	SLECIC	NHDA and HDFC	Leasing Companies	Total			
			(65)												
Resources and Uses		Commercial Banks	RRDBs	NDB	DFCC	SMIB	Merchant Banks	NSB	EPF	ETF	NI Corp. Insurance Corp. of Sri Lanka				
RESOURCES :															
1.	Deposits	44,374	3	-	-	-	-	14,140	159	1,312	11	-	10	-	63,732
2.	Capital & Reserves	3,164	32	1,195	160	99	18	154	14,723	173	2,769	62	55	116	23,268
3.	Other Liabilities	11,984	15	32	39	829	40	49	43	3	1,209	-	5,223	838	21,002
4.	Credit Refinance	2,004	0.2	796	699	-	-	-	-	-	-	-	-	-	3,879
5.	Central Bank	1,824	0.1	57	-	-	-	-	-	-	-	-	-	-	-
	NDB/Com. Banks/Others	180	0.1	-	699	-	-	-	-	-	-	-	-	-	-
	Govt./IDA/ADB	-	-	739	-	-	-	-	-	-	-	-	-	-	-
5.	Total Resources	61,526	50.2	2,023	898	928	58	14,343	14,925	1,488	3,989	62	5,288	954	111,881
USES :															
6.	Fixed, Liquid and other Assets	23,686	4.6	794	115	63	58	1,098	873	102	3,092	4	643	330	32,861
7.	Loanable Funds (5-6)	37,840	4.2	1,229	783	865	-	13,245	14,052	1,386	897	58	4,645	624	79,020
8.	Total Gross Credit (Outstanding)	38,184	4.2	1,229	783	865	-	13,245	14,052	1,386	897	58	4,645	624	79,364

Source: Central Bank of Sri Lanka and Balance Sheets and Annual Accounts of Institutions.

of these deposits are used often for transaction purposes. This is especially so of NSB savings deposits as restrictions on withdrawal of such deposits are minimal. The table also reveals that the loanable funds/total deposits ratio of the commercial banks accounted for 84 per cent of total deposits while that of finance companies accounted for 89 per cent. Although the credit creating capacity of the latter is limited when compared to the former, the type of financial facilities offered by the latter (in particular the hire purchase finance) appeared to be more consumption oriented than savings. Although there are practical difficulties in targeting M3 (M2+time and savings deposits of the NSB and the FCs), the growing liquidity outside the control of monetary policy is a matter for concern. FI has also influenced marginal shifts in money demand in Sri Lanka especially between 1977 and 1985, towards interest bearing monetary assets induced through high interest rates. In addition, there was also a notable SE between money and real assets, in particular investment in equipment and machinery and consumer durables via lease financing. Moreover, innovations such as acceptance finance played an important role in trade financing and also circumvented domestic monetary restrictions.

Fifthly, the absence of an accepted rate/range of interest rates transmitting monetary impulses to the real sector has also made it difficult to trace the MTM through a particular channel. Since 1977 the Bank Rate (BR) was

the apex and the signalling rate and this has been an effective instrument when banks experienced short term liquidity problems. The BR however, was fixed for most of the time and did not respond to changes in money market conditions.

Also, the BR would not by itself exert any significant impact on interest rates without a simultaneous change in the quantity of accommodation granted to banks. Whenever the BR was lower than the other short term rates, banks used BR borrowing for lending in the inter-bank call market (IBCM). Since 1983 the BR became inoperative and the treasury bill rate (TBR) and the central bank securities rates (CBSR) were used to signal the direction of policy.

Finally, the lags and the staggered effects involved in the shift between financial and real assets also complicates the MTM. For example, a change in the statutory reserve requirements (SRR) would first affect the money supply and interest rates and the latter in turn would affect investment and prices. It is generally accepted that a change in the rate of growth of money supply will only act on inflation and the real sector with a time lag. See for e.g. Aghevli (1979). The existence of these lags also creates monetary targeting problems. The lagged effects of monetary policy instruments also makes the identification of the MTM more difficult. Changes in SRR are designed to limit the credit creating capacity of commercial banks, to absorb excess liquidity and to help in

the achievement of BOP objectives. SRRs raise the cost of funds to banks and would lead to a reduction in deposit rates regardless of the inflation rate. Following the demand for money for short term funds, the market rates, especially IBCM rates, would tend to go up. The time lags involved in this process thus makes the identification of the MTM more difficult.

6.2 The Monetary Transmission Channels in Sri Lanka

We shall now examine the main MTCs in Sri Lanka. 6.2.1 deals with the interest rate channel. 6.2.2 examines the credit rationing channel and 6.2.3 discusses the wealth channel. We begin with historical behaviour and compare this with theoretical expectations. In doing so we shall attempt to answer the main issues listed above in order to assess the relative effectiveness of these channels.

6.2.1 The Interest Rate Channel

It is important at this juncture to highlight the virtues of high interest rates as they are important from the point of view of the MTM. First, positive interest rates are said to trigger the SE and through it readjust asset portfolios in favour of financial or real assets and discourage consumption. The policy stance therefore, is to link nominal interest rates with inflation so as to maintain positive real rates. Second, high interest rates reflecting the true cost of funds is thought to be instru-

mental in bringing about an allocative efficiency in the economy through the market mechanism. Third, high nominal rates are expected to bring about structural changes by encouraging labour as against capital intensive production techniques. Finally, nominal rates linked to inflation are expected to intensify the use of credit in the economy by increasing turnover and making repayments quicker, thus allowing a larger group of borrowers to use loanable funds.

The following are the key issues that need to be addressed with regard to the effectiveness of the interest rate channel. Are interest rates market determined and do they reflect the true cost of funds? How does the substitution effect take place when interest rates are not market determined? Is there a link between short and long term interest rates in Sri Lanka? Are financial assets perfectly substitutable? If not, what is the degree of substitutability among them? Are financial and real assets substitutable? What is the time lag involved in the transmission process? How safe and attractive are real assets?

In the following sections we shall discuss the historical behaviour of the interest rate channel and attempt to answer the key issues raised above. In this regard it is logical to start with the main features and the structure of interest rates in the post 1977 period. Prior to 1977, a low interest rate policy was pursued and interest rates were infrequently adjusted, thus resulting in negative real rates. In 1977, as a part of the open

economic policy package, a high interest rate policy was pursued with the longer term objective of deregulating interest rates. For purposes of clarity and convenience we divide the period into two sub-periods: 1977-1982 and 1983-1985. The first period consisted of two major interest rate reforms. During the second, interest rate policy was more flexible and market oriented.

a. 1977-1982

Effective August 1977, the CB set the pace by increasing the BR from 8.5 to 10 per cent per annum. To discourage banks from resorting to CB funds, a penal rate (PR) was introduced at 15 per cent on borrowings over and above the BR accommodation. The TBR and the GSRs were raised to 9 and 12 per cent per annum respectively. The NSB raised its deposit rate structure and the commercial banks and the medium and long term lending institutions (MLTLI) followed suit. Interest rates on savings deposits of commercial banks rose from 7.2 to 8.4 per cent while time deposit rates ranged between 12 and 18 per cent per annum depending on the maturity period (Table 6.2). By end 1977, the entire interest rates structure was raised to a higher level. Although short and long term rates varied according to the maturity period there was no visible yield curve relationship between these rates. These rates continued to be effective up to 1982.

Table 6.2

Money Rates 1977-1985
(Per cent Per Annum)

End of Period	Government Treasury Bills				Central Bank	Commercial Banks' Deposit Rates		Inter-Bank Call Loans	Government Securities	Commercial Banks' Advances Rates			
	Primary Market		Secondary Market	Discount	Rediscount	Rate on Advances (Bank Rate)	Fixed Deposits 12 months	Savings Deposits		Loans and Overdrafts	Shares Stock of Joint Stock Companies in Unsecured Trade		
	Central Bank	Other	Rate on Advances (Bank Rate)									Fixed Deposits 12 months	Savings Deposits
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
1976	3.24	5.00	-	-	6.50	7.50	5.50	8.00	14.00	13.00	14.00	14.00	
1977	9.00	9.00	-	-	10.00	15.00	7.20	9.50	18.00	19.00	19.00	20.00	
1978	9.00	9.00	-	-	10.00	15.00	7.20	9.50	18.00	19.00	19.00	20.00	
1979	9.00	9.00	-	-	10.00	15.00	9.00	11.00	18.00	19.00	20.00	21.00	
1980	13.00	13.00	-	-	12.00	20.00	14.00	25.00	28.00	28.00	28.00	30.00	
1981	13.00	13.00	15.00	15.25	14.00	22.00	14.00	18.00	28.00	28.00	28.00	32.00	
1982	13.00	13.50	12.25	13.25	14.00	22.00	4.50	18.50	30.00	30.00	30.00	30.00	
1983 1st Qtr.	13.00	13.91	12.75	13.75	13.00	22.00	14.50	19.50	30.00	30.00	30.00	30.00	
2nd Qtr.	12.00	11.98	12.00	12.50	13.00	22.00	14.50	15.00	30.00	30.00	30.00	30.00	
3rd Qtr.	12.00	12.00	12.00	12.75	13.00	22.00	14.50	24.00	30.00	30.00	30.00	30.00	
4th Qtr.	12.00	12.00	12.00	12.50	13.00	25.00	15.00	37.00	30.00	30.00	30.00	30.00	

Contd.....

End of Period	Government Treasury Bills				Central Bank	Commercial Banks' Deposit Rates		Inter-Bank Call Loans	Government Securities	Commercial Banks' Advances Rates	
	Primary Market		Secondary Market	Central Bank Rate on Advances (Bank Rate)	Fixed Deposits 12 months	Savings Deposits				Loans and Overdrafts	
	Central Bank	Other	Discount								Rediscount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1984 1st Qtr.	12.00	-	12.00	12.75	13.00	25.00	15.00	35.00	30.00	30.00	30.00
2nd Qtr.	15.00	13.50	12.00	12.75	13.00	24.00	15.00	17.00	30.00	30.00	33.00
3rd Qtr.	14.00	14.00	14.00	14.20	13.00	23.00	15.00	16.00	30.00	30.00	33.00
4th Qtr.	14.00	14.00	14.00	14.20	13.00	22.00	15.00	15.50	30.00	30.00	33.00
1985 1st Qtr.	14.00	14.00	14.00	14.20	13.00	22.00	15.00	14.50	30.00	30.00	33.00
2nd Qtr.	14.00	14.00	14.00	14.20	13.00	22.00	15.00	15.00	29.00	30.00	33.00
3rd Qtr.	13.00	13.00	12.80	13.00	13.00	22.00	15.00	13.75	29.00	30.00	33.00
4th Qtr.	11.50	11.52	11.30	11.50	11.00	18.00	13.50	14.00	29.00	28.00	30.00

Source: Central Bank of Sri Lanka

Columns 6 - 12 refer to maximum interest rates.

b. 1983-1985

Since 1983 the market responded differently to interest rate increases and did not always follow the rates initiated by the CB and the NSB. The TBR, CBSR and the GSR were fixed for most of the time although IBCM rates fluctuated according to market forces and due to uncertainties. The BR advances ceased to operate since 1983 and it was no longer considered the relevant signalling rate. Reflecting the links with the inflation rate throughout 1984 (9 per cent) and 1985 (1.5 per cent) rates dropped substantially on deposits and marginally on lendings. On the whole, the upper end of the deposit rates was largely determined by the state banks and the NSB and the lower end by the TBR. Lending rates were determined largely by the deposit rates, the type of customer and the purpose of borrowing. At the end of 1985 lending rates of commercial banks stood at a range of 15 per cent for prime customers and 30 per cent per annum for the others. Lending rates of the FCs were typically high due to the risky nature of their business. An important feature observed in the interest rate structure is that except for the interest rates on the negotiable bearer certificates of deposits (CDs) which are sold at low discounts due to tax exemptions, the differences in the rates of similar maturities were very small. Therefore, short term financial assets, in particular savings and time deposits, were close substitutes.

We shall now proceed with a discussion of the role of interest rates as a MTC by examining their impact on selected aggregates including the money supply and inflation; the financial assets ratio; financial savings; the money market and capital market transactions. The real sector variables discussed include growth; consumption; domestic savings; investment and capital formation.

Money Supply and Inflation

Immediately after the 1977 upward revision of interest rates, M1 growth and inflation decelerated. As shown in Appendix table 3.1, M1 dropped to 11 per cent in 1978 and prices remained moderate through the first half of 1979. However, M1 growth accelerated to 29 per cent and M2 to 38 per cent in 1979. Inflation fuelled by excess liquidity in the system rose to 25 per cent by the end of 1980. The second major interest rate reform effected in April 1980, therefore, was either too late or was not strong enough to channel monetary impulses effectively. Negative real interest rates throughout 1980 triggered a limited SE between monetary and real assets and raised the demand for more cash balances.

Monetary and price increases in 1981 and 1982 were more moderate compared to the two preceding years and inflation dropped to 18 per cent in 1981 and further to 5 per cent in 1982. As pointed out by Jayamaha and Jayatissa

(1984) it is important to note that the achievement of monetary and price stability was the result of a well coordinated macro economic policy package effected since 1981 within which the interest rate adjustment was only one instrument. Prior to 1981, however, inflation remained high despite the prevalence of positive real rates and high interest rates were probably not very effective as an anti inflationary measure.

Financial Assets Ratio

The M1/GDP ratio dropped from an average of 14.3 per cent during 1968-1976 to 13.1 per cent during 1977-1985 indicating a SE between money and interest bearing monetary assets (Table 6.3). Fluctuations in this ratio indicated the trends in real interest rates, inflation and the civil disturbances. The M2-M1/GDP ratio doubled from an average of 8.1 to 16.2 per cent during the same period. Surprisingly, the M3-M2/GDP ratio (including deposits of the NSB and FCs) declined from 13 per cent in the low interest rate period to 11 per cent during the high interest period. This indicated the predominance of primary and secondary liquid assets (money and quasi-money) compared to the other deposits reflecting partly the difficulties of withdrawals, the non-availability of financial facilities (trade finance and overdrafts) from non-bank institutions and in recent years, the risks of depositing with the FCs. On the whole, the growth in the ratio of total financial claims to GDP, (M3/GDP) which represent the formal finan-

cial sector, rose from an average of 36 per cent during the former period to 40 per cent in the latter period.

Table 6.3
Financial Asset Ratios in Sri Lanka 1968 -1985
(In Percentages)

Year	M1/GDP*	M2-M1/GDP	M3-M2/GDP	M3/GDP
1968	13.6	8.7	12.9	36.5
1969	13.9	8.2	13.2	34.2
1970	14.6	9.1	13.4	37.1
1971	15.8	9.2	13.8	39.7
1972	16.3	9.8	14.2	41.5
1973	15.7	7.5	14.5	37.1
1974	12.9	6.8	12.9	32.1
1975	11.8	6.6	12.8	31.0
1976	13.8	7.1	13.0	33.9
1977	14.7	9.2	12.2	36.4
1978	13.9	11.6	12.5	38.0
1979	14.6	14.1	12.7	41.4
1980	13.8	15.3	10.5	39.6
1981	11.1	16.9	9.5	38.6
1982	12.8	20.5	9.1	41.4
1983	13.4	20.4	9.4	42.3
1984	12.2	19.2	10.2	41.4
1985	11.5	18.2	11.0	44.1

* GDP at market prices.

This indicates that high nominal interest rates had a positive impact on the accumulation of financial savings since 1977, except in 1980, deposit rates remained positive in real terms (Table 6.4) which promoted a sharp increase in total financial savings from about 34 per cent of GDP in 1976 to about 40 per cent in 1980 and further to 44 per cent in 1985 (Table 6.3). The relationship between real interest rates and financial savings indicates, therefore, that of the three main components of financial savings (money, quasi-money, provident funds and life insurance funds), the first two are interest sensitive. Moreover,

Table 6.4

Rates of Interest
(in %)

Year (1)	% Rise in Cost of Living Index (cp) (2)	Fixed Deposits at Comm- ercial Banks (1 Yr.)		Fixed Deposits at NSB (1 Yr.)		% Change in GDP Deflator (7)	Real Rates * (8)
		Nominal Rate (3)	Real Rate * (4)	Nominal Rate (5)	Real Rate (6)		
			(3) - (2)		(5) - (2)		
1971	+ 2.7	4.75	+ 2.0	7.5	+ 4.8	+ 3.5	+ 1.2
1972	+ 6.3	4.75	- 1.5	7.5	+ 1.2	+ 4.3	+ 0.4
1973	+ 9.7	4.75	- 4.7	7.5	- 2.2	+17.2	-12.5
1974	+12.3	4.75	- 7.7	7.5	- 4.9	+26.0	-21.3
1975	+ 6.7	7.50	+ 2.3	7.5	+ 2.3	+ 7.3	+ 0.2
1976	+ 1.2	7.50	+ 6.3	15.0	+13.8	+ 5.7	+ 1.8
1977	+ 1.2	15.00	+13.8	15.0	+13.8	+19.0	- 4.0
1978	+12.1	15.00	+ 2.9	15.0	+ 2.9	+ 8.0	+ 7.0
1979	+10.8	15.00	+ 4.2	15.0	+ 4.2	+15.9	- 0.9
1980	+26.1	20.00	- 6.1	20.0	- 6.1	+18.2	+ 1.8
1981	+18.0	22.00	+ 4.0	20.0	+ 2.0	+20.3	+ 1.7
1982	+10.8	22.00	+11.2	20.0	+ 9.2	+10.2	+11.8
1983	+14.0	25.00	+11.0	18.0	+ 4.0	+14.8	+10.2
1984	+16.6	22.00	+ 5.4	20.0	+ 3.4	+17.4	+ 4.6
1985	+ 1.5	18.00	+16.5	15.0	+13.5	+ 1.5	+16.5

Source : Central Bank of Sri Lanka

* Real Interest Rate is calculated by deflating the nominal interest rates by the % change in the CP and the GDP deflator.

Table 6.5

Financial Savings, 1977-85
(As a per cent of GDP)

	1977	1978	1979	1980	1981	1982	1983	1984	1985
Financial Savings ¹	8.5	9.9	13.4	10.8	7.3	11.3	10.1	8.3	6.9
Broad Money	6.8	8.0	11.6	9.1	5.7	9.6	8.2	6.4	4.8
Money (M1)	1.5	1.3	3.3	2.5	0.7	1.7	2.4	1.3	1.2
Current outside banks	0.6	0.5	1.4	0.6	0.8	1.2	1.0	0.9	0.8
Demand deposits	-	0.8	1.9	1.9	-	0.6	1.4	0.5	0.5
Central Bank	-	-	-	-	-	-	-	-	-
Commercial banks	0.9	0.8	1.9	1.9	-	0.6	1.4	0.4	0.5
Quasi-money	5.3	6.7	8.3	6.6	5.0	7.8	5.8	5.0	3.6
Savings deposits ²	0.9	0.8	1.2	0.5	0.9	1.8	0.9	1.3	1.5
Commercial banks	0.6	0.5	0.9	0.3	0.7	1.6	0.6	1.0	1.2
NSB	0.5	0.2	0.4	0.2	0.1	0.2	0.3	0.2	0.2
Time deposits	3.2	4.6	5.4	6.3	4.5	5.5	4.9	3.6	1.8
Central Bank	0.1	0.2	-0.1	0.2	-	0.2	-	-	0.4
Commercial banks ²	3.0	3.2	3.7	4.3	3.9	2.7	2.4	1.7	0.7
NSB	1.1	1.2	1.8	0.8	0.5	2.0	1.2	1.2	0.6
Finance companies	-	-	-	0.6	0.2	0.5	0.3	0.7	-
FCBUs	-	-	-	0.3	-	0.1	1.0	0.1	0.2
Other deposits	1.2	1.4	1.6	-0.1	-0.4	0.5	0.1	0.2	0.3
Commercial banks ³	1.0	1.1	1.6	-0.2	-0.4	0.3	-0.1	0.1	-
NSB ⁴	-	0.3	-	-	-	0.2	0.1	-	0.3
Actuarial reserves & members' balance	1.7	1.8	1.8	1.6	1.6	1.7	1.8	1.9	2.1
EPF: Members' balances	1.5	1.6	1.5	1.4	1.3	1.4	1.5	1.5	1.9
ETF: Members' funds	-	-	-	-	0.1	0.2	0.3	0.3	0.2
INSCO : Life Insurance fund	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	-

Source : Central Bank of Sri Lanka

1. Defined as change in broad money (money plus quasi-money) plus changes in actuarial plus members' balances.

2. The breakdown of commercial bank time and savings deposits for the period 1977-82 has been estimated using the same proportions reported for all time and savings deposits of commercial banks, including government, import and non-resident deposits

3. Import deposits and GPS suspense account

4. Savings certificates, premium savings bonds, pension scheme and interest due on deposits.

net capital flows (private) and transfers from abroad (in particular multi-national investments) significantly influenced the fluctuations observed in financial savings. Table 6.5 shows that financial savings reached the peak in 1979 (13.4 per cent of GDP) and gradually dropped towards the end of the period.

Money Market- The Substitution Effect

As far as the SE triggered by the high interest rates is concerned, during the first few years of the high interest rate period the response of the public to small differentials in short term interest rates was slow due to the limited availability of financial instruments. As seen in table 6.6 the FI introduced dynamism into the money market, widened the range of instruments and increased the fund movement. High interest rates, therefore, together with the FI triggered the SE in a significant manner.

Fund movements were notable towards instruments on which the real interest rate was positive (except in the primary TBM due to negative real rates). An interesting feature to note is the limited participation of the non-bank public in most sub markets. In terms of OMO however, it makes no difference whether the CB directly deals with banks or non-banks as long as these two sectors are free to adjust their portfolios with each other as all changes in the MB will be reflected through per unit of currency. It is also notable that the SE envisaged in theoretical expo-

Table 6.6

<u>Money Market Operations</u>		<u>(outstandings as at end of period)</u>										<u>(Amount in Rs. Million)</u>			
		1977	1978	1979	1980	1981	1982	1983	1984	1985					
Primary Treasury Bills		2,500	2,635	3,000	9,800	13,920	17,320	17,400	14,860	22,280					
Secondary Treasury Bills ¹		-	-	-	-	684	136	59	1,563	1,529					
Central Bank Securities ²		-	-	-	-	-	-	-	557	1,168					
Operations in the Call Money Market		103	254	127	539	869	1,250	914	992	630					
Certificate of Deposit - Commercial Banks		-	-	-	-	77	322	610	908	1,068					

Source: Central Bank of Sri Lanka

1. Outstanding net sales and buying and selling rates respectively are indicated in respect of the Secondary Treasury Bills Market.

2. The outstanding amounts of securities and average yields are indicated.

sitions by "Keynesians" did not take place in Sri Lanka during the post 1977 period despite high interest rates. The GS market continued to be captive and investments in these securities reflected a "locked in effect" as there was no secondary market and real returns were negative. It is therefore, clear that the SE triggered by interest rates was visible only between money and short-term financial assets but not between money and long term financial assets such as GS or long term bonds. Although investment in GS was safe, they were not attractive since they offered fixed interest income inadequately compensating for inflation.

Capital Market - The Substitution Effect

As far as the SE between money and long term financial assets in the capital market (CM) is concerned, one important issue is whether high interest rates discouraged the transfer of funds from the money market to the CM. The CM in Sri Lanka featured only share market (SM) activities and was confined to only a few firms. Therefore, excess liquidity in the money market did not find its way to the CM despite negative real returns on financial assets especially in 1980. Hence, there was no notable SE between short and long term financial assets largely due to the inherited limitations of the CM.

On the other hand, in the primary share market (new issues), both the number (valued at Rs 94 million) and the shares offered (valued at Rs 1004 million) recorded a peak

in 1983 (table 6.7).

Table 6.7
Number of New Share Issues (Primary Market)
During 1980-1985 by Type of Investment (in RS Million)

Type of Investment	1980	1981	1982	1983	1984	1985
1.Manufacturing	1	7	6	14	5	-
2.Banks and Finance	-	2	1	2	-	-
3.Investment Trusts	-	-	-	-	-	-
4.Land and Property	-	-	1	3	3	2
5.Stores and Supplies	-	-	-	-	-	-
6.Hotels and Travels	3	3	8	9	4	1
7.Beverages,Food and Tobacco	1	1	1	4	-	-
8.Services	-	-	-	4	-	-
9.Trading	-	-	2	1	1	-
10.Oil Palm	-	-	-	-	-	-
11.Total	5	13	19	37	13	3
12.No: of shares (in Rs.Mn)	1.39	28.4	37.11	94.0	63.25	10.75
13.Value of shares (in Rs Mn)	13.9	284.7	371.1	1004.2	632.5	130.5

Source: Central Bank of Sri Lanka

The unprecedented increase in the activities of the SM (1983) has been attributed to fiscal incentives offered to both public companies and share holders, including the amendment of the Companies Act, the establishment of the new Stock Exchange in late 1982 and the drop in interest rates in the money market. As seen in table 6.7, the highest traded values in the secondary share market were recorded in 1982 and 1983 and declined thereafter. However, the SE between financial assets in the money market and the CM has not been impressive (except in 1983). Moreover, the contribution of interest rates appears to be marginal compared to institutional developments and fiscal incentives.

Another question is whether high interest rates triggered a SE between financial (both money market and CM assets) and real assets. Real assets in Sri Lanka comprise land, machinery and equipment, housing and hoarding of jewels and gold. Despite high interest rates, inflationary tendencies dominated and hence there was a significant increase in the demand for real assets (in particular land^{1/} in Colombo) during the three years ended 1980 . Data constraints do not allow an assessment of the SE between money and gold and jewellery holdings, but machinery and equipment became popular following the introduction of lease financing. At the end of 1985 the leasing companies held an outstanding assets portfolio of Rs 624 million indicating the gradual picking up of the SE between financial and real assets.

Since there is no organised system in Sri Lanka for housing finance along the lines of the Building Societies of the U.K or Savings and Loan Associates in the U.S.A, investment in housing is relatively risky and unattractive. The State Mortgage and Investment Bank (SMIB) is the largest specialized institution for housing finance and its sources of funds are the government and government sponsored institutions.

In sum, it is clear that the SE triggered by high interest rates between 1977-1985 was prominent between

money and short term financial assets but not between money and bonds or long term assets. Secondly, although interest rates were used as an anti-inflationary measure there is little evidence to suggest that interest rates alone were capable of achieving these objectives. The effectiveness of interest rates may have been further strengthened by a number of other monetary policy measures. Thirdly, high interest rates achieved their objective with regard to the accrual of financial savings and raising the financial assets/GDP ratios. In the capital market, however, fiscal policy incentives seem to have been more influential than high interest rates. Finally, the SE between monetary and real assets was largely confined to land, machinery and equipment and consumer durables.

We now turn to the impact of interest rates on real sector variables, beginning with growth.

Growth

The response of real sector variables to monetary impulses via interest rates indicates mixed results. The growth rate in real GDP which recorded an average of 3 per cent prior to 1977 rose to 6 per cent during 1977-1982 and remained around 5 per cent during 1977-1985 (see table 6.8). Despite the availability of low cost credit to key growth sectors, their performance was poor especially towards the end of this period. It is likely that adverse weather conditions, ethnic disturbances since 1983 and the

heavy competition for domestic industrial products were more influential on growth than the cost of capital (net interest rates).

Consumption

Despite the accrual of high financial savings total consumption expenditure did not fall as one would expect. Total consumption expenditure as a ratio of GDP (at market prices) stood at 0.8-0.9 both before and after the interest rate reforms partly due to the rising money income and negative real rates on some financial instruments (see Annual Report of the Central Bank of Sri Lanka, 1985). The income elasticity of consumption expenditure, a key indicator of consumption has been well over unity during this period. The virtually unchanged consumption expenditure seems to indicate the importance of income compared to interest rates in determining consumption.

Domestic Savings

Domestic savings as a percentage of real GDP fluctuated between 14 and 22 (Table 6.8). While this was better than many other countries at a similar stage of development, it is low when compared to the ambitious investment programme undertaken during 1977-1985. The savings performance varied significantly during this period. The influence of the external sector (in particular the adverse terms of trade) appeared to have offset the positive impact of high interest rates and this was further

aggravated by the dissavings of the government and the corporate sector during this period.

Table 6.8
Domestic Savings and Investment Performance (1977-1985)
In per cent of GDP*

	1977	1978	1979	1980	1981	1982	1983	1984	1985
Real GDP									
Growth	4.2	8.2	6.3	5.8	5.8	5.1	5.0	5.0	5.0
Investment	14.0	20.0	25.8	33.8	27.8	30.6	28.8	25.8	24.9
Domestic									
Savings	17.0	15.5	14.7	14.0	14.0	15.4	16.4	21.6	15.3
Foreign									
Savings	3.0	4.5	11.1	19.8	13.8	15.2	12.4	4.2	9.4

* real GDP

Source: Central Bank of Sri Lanka

Investment and Capital Formation

Capital formation and investment which are usually negatively correlated with high interest rates, recorded opposite results. Capital formation as a ratio of GDP (at market prices) rose from a range of 14-17 per cent (prior to 1978) to 25-34 per cent over 1978-1985 (Table 6.8). A preliminary survey^{2/} done on selected public corporations and a few private sector companies revealed that even during the high interest rate period (nominal rates at 30 per cent), interest cost has not been a deterrent to expand investment activities. It was revealed that they were able to borrow at rates which were only marginally higher than deposit rates. In fact, labour charges and cost of raw materials were more significant than the interest cost.

The Planned Investment Survey by the Central Bank of Sri Lanka (1980) showed that the interest cost to the major companies has been minimal. The weighted average lending rate almost doubled in the post 1977 period from 9 per cent per annum during 1968-1976. However, real lending rates rose from a negative average of 3.5 per cent during 1968-1976 to a positive 4.5 per cent during 1977-1985. The relatively low real lending rates were attributed to the inflationary tendencies, the availability of subsidized credit to priority areas and the favourable rates at which the private sector borrowed funds (institutional reasons). High lending rates no doubt acted as a criterion for re-scheduling investments but do not appear to have exerted any adverse impact on investment funds via real lending rates during this period.

6.2.2 The Credit Rationing Channel (CRC)

Table 6.9 suggests that domestic credit expanded rapidly between 1977 and 1985, especially the share accounted for by the private sector (gross). The public sector's share remain unchanged since 1977 but credit to both sectors as a ratio of GDP has been high. The distribution of commercial bank credit to the private sector has been stable except for a decline in the relative share of agriculture. On a priority basis, exports, agriculture and industries were to receive more credit through SCCs although they were at best a modest success and probably only

Table 6.9

Domestic Credit of the Financial System, 1977-85

	1977	1978	1979	1980	1981	1982	1983	1984	1985
	(As a percentage of GDP) *1								
Domestic Credit	47.8	51.2	56.2	66.6	65.3	69.3	68.1	58.2	63.5
Claims on Government (net)	30.4	28.7	31.1	37.8	35.6	38.0	35.2	27.6	32.3
Claims on Private Sector	17.4	22.5	25.1	28.8	29.8	31.3	32.9	30.6	31.2
Public Corporations	4.6	5.5	6.4	6.3	5.5	4.8	3.7	2.8	2.8
Co-operatives	3.4	3.9	3.6	2.1	1.5	1.2	1.5	1.0	0.8
Other	9.4	13.0	15.1	20.5	22.8	25.3	27.7	26.7	27.6
	(Percentage distribution)								
Domestic Credit	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Claims on Government (net)	63.7	56.0	55.3	56.7	54.4	54.9	51.7	47.5	50.8
Claims on Private Sector	36.3	44.0	44.7	43.3	45.6	45.1	48.3	52.5	49.2
Public Corporations	9.6	10.7	11.4	9.5	8.4	6.9	5.4	4.8	4.4
Co-operatives	7.1	7.7	6.5	3.1	2.3	1.7	2.2	1.8	1.3
Other * 2	19.7	25.4	26.9	30.8	34.9	36.5	40.7	45.9	43.5

Source : Appendix Tables, Annual Review 1986
Central Bank of Sri Lanka

*1 GDP at market prices.

*2 Including credit by the FCBUs to other approved enterprises.

prevented a further decline in production.

SCCs in general, and credit ceilings in particular, were to supplement general credit measures (SCCs effected during this period are given in Appendix 3.2). Although most SCCs were implemented through moral suasion, CR was enforced through regulations. Banks observed the overall ceilings as a group but not on an individual basis. In many instances they managed to get exemptions. Moreover, due to classification problems and non-compliance, strict monitoring was difficult. Historical observations reveal that whenever CR was introduced there were corresponding increases in interest rates. This may be because banks and financial institutions reacted to CR by lending the same amount of funds at higher rates thereby maintaining profit levels. Therefore, in practice the impact of CR was felt more in terms of higher interest rates than a reduction in the availability of funds. From the point of view of the identification of the MTC it is difficult to separate out the impact of interest rates and CR. The real impact of CRE, however, appears to be in terms of the introduction of distortionary effects on financial transactions. In the sections below we shall examine the impact of CR in selected areas starting with real investment.

Real Investment

The success of CR as an MTC depends largely on the degree of substitutability of funds (the availability effect). During the period under review the CB provided

subsidised credit under the refinance schemes to ensure that priority investments were not affected by the CR. Moreover, priority sectors were exempted from all SCCs imposed during the 1977-1985 period. From a conceptual point of view, CR would influence the borrowers' cost of funds and the expected rate of return and hence the budget constraints of individual firms. However, insofar as interest rates adjust to eliminate excess demand and supply (in the ICMs) then the impact of CR would not be felt, and this situation may lead to an undermining of the existing monetary policy measures. This is also confirmed by the high credit multipliers of ICMs during this period. The form in which CR was effected in Sri Lanka also allowed the borrowers to resort to alternative sources of funds thus avoiding its cost effects. The Financial Survey (table 6.1) reveals that the substitution of bank credit by FCs and ICMs filled credit gaps in the non-priority sectors. Hence, the overall impact of the CR on investment and inventories was not significant.

Cost Of Borrowing and Effective Failure of Supply

In Sri Lanka for large firms, business organisations and public corporations, the impact of CR has been minimal as they borrow at favourable rates from commercial banks. In addition to bank borrowings some of these firms were allowed to borrow abroad for short term trade credits. They channeled these transactions through FCBUs and ar-

ranged acceptance finance, a facility that was allowed since 1979. CR therefore, exerted only a negligible effect on the cost of borrowing as most big firms resorted to inward remittances for working capital or borrowed against cash collateral. On the other hand, priority sectors were looked after through refinance schemes of the CB, development credit institutions or through subsidised credit programmes of the government. Therefore, the CRE did not result in an effective failure of supply during the period under review. In many instances the CRE was overshadowed by interest rate effects because credit was made available to the system at a higher cost, represented by high lending rates.

Financial Disintermediation

The shift towards alternative sources of funds when the formal sector imposed CR may have led to some degree of financial disintermediation (FD). The FD has far reaching implications for Sri Lanka because the CR was not uniformly applicable on all financial institutions. Secondly, CR forces commercial banks to maintain idle reserves and it acts as a 100 per cent marginal reserve requirement. If the economy is fully open and if ceilings are imposed only on domestic credit, deposit inflows would tend to be lent abroad when the ceilings are reached. There is no evidence of deposit outflows, except the increasing "errors and omissions" item in the balance of payments entries. A good part of these outflows would have to be attributed to

illegal transfers. Therefore, the FD would in this case have discouraged deposit inflows to banks thereby driving customers to the ICMs.

6.2.3 The Wealth Channel

The measurement of wealth is ambiguous and it is difficult to measure wealth using one particular proxy. As long as real cash balances are a part of wealth, there will be widespread WE via income changes. The question is whether the wealth channel (WC) was able to trigger SE via money balances in Sri Lanka during our period. WE can be measured using two criteria. The first takes money as a factor of production and the second examines portfolio shifts among assets. The first assumes that money is part of wealth while the second assumes that portfolio shifts will be triggered by interest rates which can be proxied by interest elasticities.

Following Paul and Bhattacharay (1981) we assumed that real money balances are part of wealth and calculated money's output elasticity in order to measure impact of real balances and hence the wealth effect. However, the calculations did not lead to sensible results. We therefore turned to the second criteria to examine its applicability to Sri Lanka.

In Sri Lanka, the major liquid assets of the private sector consist of cash, treasury bills, savings cer-

tificates, and fixed and savings deposits. The non-liquid portfolio consists of consumption goods, real assets etc. Long term mortgages and trading of GS are not popular because returns are low on the former and the latter are not tradable as there are no secondary markets. There is no housing market or unit/investment trusts to transact in private or corporate bonds. Portfolio shifts are, therefore, limited between money and financial assets, which respond to interest rate differentials. Company sector financial assets grew steadily after 1977. Most companies hold CDs due to tax advantages and as collateral. Company investments in the SM depends on the rate of return, investment relief, viability of projects and the political situation in the country. As seen in most developing financial markets the net financial position of the non-bank private sector vis-a-vis the banking sector does not seem to have any significant influence upon the former's portfolio decisions. Similarly, wealth had no role to play as a variable in the net public sector debt. In the company sector, portfolio balances have been limited to borrowings and the firms' retained earnings. In any case the firms in Sri Lanka are more bank oriented compared to those of equity or market oriented firms in the USA or the UK. This supports the view that the use of portfolio shifts among sectors as a criteria to measure WE cannot be considered a proper proxy in Sri Lanka.

Thus it seems that there is no proper proxy to

measure WE in Sri Lanka. However, by analysing portfolio shifts we concluded that part of the wealth effects are represented through changes in real balances and hence are effected by the money supply.

6.3 Observations From the Empirical Model

There are two approaches to analysing the role of MTM in macro simulation models. One is concerned with the identification of the channels in single equations or possibly single sectors of the model with emphasis on the magnitude of the coefficients on the variables concerned. The second is a complementary approach concerning the impact on the complete model through simulation. We have used both of these techniques.

From our empirical model in chapter 4 we found that the interest rate variable was significant in all three money demand equations which indicates some degree of SE among financial assets. We measured the SE between money and alternative assets using the interest elasticity of the demand for money. Table 6.10 shows the percentage change in money associated with a percentage change in interest rates on alternative financial assets. If $SE > 1$ it means that a small change in interest rates, or alternatively financial assets, is accompanied by a large fall in the demand for money reflecting an elastic degree of substitution. Similarly, the shift towards interest bearing monetary assets is seen in the positive elasticity of .231

in time and savings deposits.

Table 6.10
Interest Elasticities of Money Demand

	Short-term	Long-Term
1. Demand for Currency	-.308	- 1.28
2. Demand for Demand Deposits	-.248	- 0.54
3. Demand for Time and Savings Deposits	.231	0.347

These elasticities conform to the observations we noted from the historical behaviour of interest rates. In the context of the real sector equations, however, we did not find the direct impact of interest rates to be significant. We observed that interest rates affected the real sector via monetary variables thus transmitting monetary impulses to the rest of the economy.

We did not find the expected rate of inflation (π) to be significant in our model. This does not mean that the substitution between money and /or financial assets and real assets did not occur in Sri Lanka but we might not have found a suitable proxy for the rate of return for fixed assets. Insofar as the change in nominal interest rates are the consequence of changes in interest variability (uncertainty), inflationary expectations may have important effects on economic activity and hence on the effectiveness of the interest rate channel. We tried to capture the impact of interest rates on real expenditure but were unable to obtain any significant results. It is possible

that in the aggregation of real expenditure the positive impact on the sub sectors disappeared.

The estimated equations in our model also captured the direct effects of CR. The import equation, in particular, showed the significance of import credit on the volume of imports. The importance of the "Availability Effects" is seen through the DC variable in the demand for time and savings deposits equation. As explained in an earlier chapter the availability effects are as strong as the interest rate effects in the determination of the demand for time and savings deposits.

The WE was in part captured in the real sector equations through broad money (BMO/cp). It influences real expenditure and the price level in a significant manner indicating the importance of broad money or the total liquidity in the system. The specification of our model, however, does not allow us to directly measure WE as we did not have a proper proxy for wealth. The implicit argument of the portfolio balance approach suggests that following an expansion in the money supply (if no short term loans are made) the banks would then buy long term bonds. Interest rates will then change and there will be WEs. If, however, short term loans are made to customers then the commercial loan rate will go up and hence there will be portfolio changes. The latter appears to be of some relevance to Sri Lanka although administratively fixed interest

rates, the non-attractiveness of GS, and the non-availability of secondary markets are not very conducive to portfolio shifts. Therefore, in Sri Lanka the changes in the speed of spending and adjustments in portfolios cannot easily be traced.

Having analysed the single equation or the intra-sector SE, CRE and the WE, we shall now consider the impact of interest rates on the model as a whole, based upon our simulations using interest rates and CR as exogenous variables, both by themselves, and in connection with other policy instruments. This is essential to the understanding of how these variables influence the transmission process in a complete model.

When we compared our dynamic multipliers and elasticities with the SEACEN (1981) study we shocked RST by 5 per cent. The SE between money and the other financial assets and the rest of the economy was confirmed by the simulation results, in particular, in the three demand for money equations. As discussed in chapter 5 (table 5.17) significant impacts were seen on the monetary variables indicating the SE between interest bearing and non-interest bearing assets. The transmission of the interest rate impact to the real sector was seen in the reduction in total expenditure and real income. In line with the historical behaviour of interest rates, change in RST in our model did not exert any direct impact on the BOP. However, in the policy analysis chapter, we repeated our simulation

experiments with a view to assessing the relative strength of exogenous policy shocks and found that RST exerts more powerful and more widespread effects on the macro economy than the wealth and credit rationing effects.

We then repeated our simulation experiments to evaluate the CRE on the economy. The direct impact was felt on the volume of imports and hence the BOP, and through them on the rest of the economy. This experiment also revealed an alternative transmission path, one which works directly via the BOP and correspondingly through changes in net external assets. The impact is felt directly on the broad money supply, which in turn exerts significant influences on the macro economy. Although these effects are as expected, one should be careful how one interprets these dynamic multipliers as they depend heavily on the specification of the equations in the model. Moreover, the impact of credit rationing can be seen only through one equation of the model and may not be as widespread as those of the interest rate effects.

The scattered effects of WE cannot be captured using a particular variable and we assumed that money forms a part of wealth in Sri Lanka. WE are also passed through the SE as portfolio changes are linked to changes in interest rates. We endogenised broad money in our model and therefore, the direct impact was captured by using it as an exogenous variable in the real sector equations. Accord-

ingly, both the total expenditure and aggregate price level equations capture the direct effects of the money supply, which in turn influence the rest of the economy. In both equations, the money supply is highly significant and has direct consequences on the rest of the economy.

6.4 The Relative Importance of the Transmission Channels

From the foregoing it is clear that the observations from historical behaviour and the estimation results confirm the relative effectiveness of the interest rate channel, the CRE and the direct effects of the money supply. These findings are further confirmed by the simulation results. CRE appears to be the most direct channel working via the BOP and money. However, the simulation experiments suggest that the interest rate effects are more powerful and widespread than the CRE because part of the CRE are reflected via changes in interest rates. Although CRE reveals an alternative transmission channel in the simulation experiments, the historical behaviour of the major aggregates did not provide adequate support for the significance of CRE. As stated earlier, this is because part of CRE was represented via higher interest rates. In the model the impact of CRE comes via only one equation and therefore, the overall effects on the macro economy may have to be interpreted cautiously. The money supply, however, as a transmission channel appears to be direct and produces more lasting effects compared to the other channels. The impact of money is further strengthened by the fact that it

forms part of total wealth. Hence, the direct effects of the money supply can be interpreted as both wealth and liquidity effects.

Our historical analysis revealed that compared to the CRE and WE the SE triggered by interest rates appeared to be widespread in Sri Lanka over our period. The SE was further intensified by the FI experienced between 1977 and 1985 and the more open and market oriented policies followed during this period. It may however, be noted that the SE envisaged in the textbooks i.e. the substitution between government bonds and money did not take place. Instead, the SE triggered by interest rates was visible between money and financial assets and money and real assets. An interesting feature regarding the SE was the fact that the impact of various general monetary policy (SRRs) and other direct measures, in particular SCCs and CR, were reflected through changes in interest rates. For example, instead of reducing the availability of credit, most banks lent the same amount at higher interest rates. Hence, interest rates were more prominent in transmitting monetary impulses.

Interest rates were significant in all the demand for money equations in our model but we were unable to see the direct impact of interest rates on the real sector. As mentioned earlier, there was no proxy to examine the impact of the wealth channel in single equations. CRE introduced

through the DC variable proved to be significant in the empirical model but we noted only a limited impact as this variable was not significant in many of the equations. The lagged money supply had a direct impact on the real sector equations, especially on real expenditure and aggregate price level equations. The significance of the interest rate channel was further confirmed by our simulation experiments in that it influenced the transmission paths of both monetary and real aggregates. Although the direct impact of the money supply was important in individual equations, we were unable to see the overall effects through simulation experiments as it was endogenised in the monetary sector. The impact of CRE in our simulation experiments was limited but it tends to undermine the effectiveness of the interest rate channel through its influence on the demand for time and savings deposits. Table 6.11 summarises the relative effectiveness of each of these channels.

<p style="text-align: center;"><u>Table 6.11</u> Comparison of the Effectiveness of Transmission Channels</p>			
	Historical Behaviour	Estimation of Equations	Simulation Experiments
1. Interest Rate channel(SE)	limited	widespread	widespread
2. Selective Credit controls(CRE)	limited	limited	widespread
3. Wealth Effects	scattered	no proxy	no proxy
4. Money Supply	widespread	widespread	widespread

FOOT NOTES

1. Ceylon Daily News ; Business page; 08.02.1982.
2. Survey of the Impact of High Interest Rates on Selected Private Sectors Enterprises. Unpublished Report of the Research Findings of the Money and Banking Division, Department of Economic Research, Central Bank of Sri Lanka, 1984.

CHAPTER 7

POLICY ANALYSIS AND THE MONETARY CONTROL FRAMEWORK

Having identified the relatively more important transmission channels in the previous chapter we shall now engage in policy analysis in order to shed some light on the construction of a Monetary Control Framework (MCF). In Sri Lanka little or no research has been done to assess the effectiveness of different policy measures, although policy instruments are changed fairly regularly.

There are three main objectives in this chapter. The first is to provide a deeper understanding of the effectiveness of frequently used policy instruments in terms of the alternative transmission paths of monetary impulses before these instruments are assembled in a MCF. The second is to help in the selection of appropriate policy instruments, both single instruments and in combination with other instruments (policy scenarios) depending on how quickly and strongly the authorities would want to achieve their objectives, and to assess the feasibility of achieving such objectives through alternative policy combinations. The third objective is to outline the conditions necessary for the formulation of the MCF and to highlight the contribution of macro simulation models in general and our model in particular to any proposed MCF. At the present time Sri Lanka does not have an analytical framework for monetary policy formulation and it is hoped that

this thesis will provide some guidelines for the establishment of such a MCF.

7.1 Policy Analysis

For purposes of consistency we shocked all policy variables by 10 per cent of their mean historical values and calculated unit impulse multipliers. When exogenous policy variables are expressed in small percentage terms, the calculation of dynamic multipliers becomes a meaningless exercise because of the larger magnitudes involved in the endogenous variables. This is especially so when small percentage changes in RST are introduced as against large absolute values of the endogenous variables. In these circumstances, we use elasticities to interpret the dynamic response of the macro economy to changes in RST. For combined policy instruments (scenario analysis), the response is calculated by taking the difference between the two simulations, i.e. the control run and the shocked run and is expressed in the original units (Rs.million). Whenever possible we calculate separately the impact of policy instruments on both components of the money supply i.e. the monetary base (MB) and the money multiplier (mm). This is not always possible as most policy variables such as the rate of interest and statutory reserve requirements influence both MB and mm.

Our analysis is split into four components. First we examine the impact of single policy instruments on the

system via MB. Second, we repeat the analysis via mm using the most direct policy instruments. mm is a summary measure of the complex relationships between the MB and the money supply. The value of the mm is determined by behavioural relationships including decisions of the banking and non-banking sectors relating to holdings of excess reserves, currency and deposits. Thirdly, we conduct scenario analysis taking various policy combinations and finally, we look at the effects of the changes in non-policy instruments on the macro economy.

7.1.1 Single Policy Instruments

From a policy point of view we selected net credit to government (NCG), gross credit to commercial banks (GCB) by the Central Bank, and net foreign assets of the Central Bank (NFACB) as instruments directly affecting the MB. NCG and GCB represent net domestic assets (NDA).

Increases in any of the above components would directly raise the money supply through identity (6) in chapter 4 and spill over to income, prices and the BOP. The effect is expansionary on the money supply, real expenditure and real income and worsens the BOP due to high imports and capital outflows. Appendix table 7.a shows that an increase in NCG is stronger in its impact than a rise in interest rates. It must however, be pointed out that the response of the macro economy to these policy shocks appears to be very strong as this exercise assumes

no policy reactions from the policy making authorities. One should therefore, be cautious in interpreting these results in a literal sense, but see these experiments as providing information to the policy making authorities prior to the introduction of new policy measures.

Table 7.1 is a summary table highlighting the important channels through which the impact of an increase in NCG is passed on to the rest of the economy.

<p style="text-align: center;"><u>Table 7.1</u> A 10 per cent increase in the MB via a 10 per cent increase in NCG</p>						
	Period	Real Time and Savings Deposits	Real Broad Money	Aggregate Price Level	Real Income	Balance of Payments
IMPACT	5	.812	4.20	0	0	0
DELAY	10	.259	.582	.001	.268	-.004
INTERMEDIATE	15	.092	.243	.001	.369	-.038
	20	.077	.173	.001	.146	-.039
LONG-RUN	36	3.47	10.61	0.418	7.77	-.994

The impact multipliers on time and savings deposits and broad money are 0.81 and 4.2, while the long term multipliers are 3.47 and 10.61 respectively. Real income responded positively with a long term multiplier of 7.8, and as expected, the BOP deteriorated further by 0.99 in the long run. The impact is delayed on all real sector variables and the BOP due to lagged effects. Prices react positively although the impact is marginal and delayed.

Two important features emerge from this analysis. The first is the dual impact of an increase in NCG via the money supply on the real sector, and directly via real expenditure. The second is the ability of our model to analyse the consequences of deficit financing on the economy even though it is not specified to take fiscal policy directly into account.

Table 7.2 below shows the impact of expanding credit to priority sectors through gross credit to commercial banks (GCB) and the channels through which the impact is passed on to the rest of the economy.

<p style="text-align: center;"><u>Table 7.2</u> A 10 per cent increase in the MB via a 10 per cent increase in GCB</p>						
	Period	Total Reser- ves	Total Real Expendi- ture	Real Income	Balance of Pay- ments	Real Broad Money
IMPACT	5	.030	0	0	0	4.076
DELAY	10	.014	.296	.291	-.004	.633
INTERMEDIATE	15	.005	.452	.403	-.042	.264
	20	.006	.203	.159	-.044	.188
LONG-RUN	36	.235	9.603	8.652	-1.088	11.05

As expected, the impact is similar to that of an increase in NCG. For example, the long run real expenditure multiplier is 9.60 and for real income is 8.65. As before, the BOP deteriorates, although part of the GCB is geared to the provision of export refinance, a facility

designed to reduce the cost of Sri Lankan exports. The impact on the money supply is also relatively large (11.05). These multiplier effects confirm the importance of changes in the MB and the predictability of the impact on the economy with the help of a small aggregative model of this nature. From a policy point of view, however, it may be noted that it is much easier to control GCB rather than NCG, since the former is at the discretion of the Central Bank. Table 7.3 shows the effects of a 10 per cent increase in the MB via a 10 per cent increase in NFACB.

Table 7.3
A 10 per cent increase in the MB via a 10 per cent increase in NFACB.

	Period	Real Time and Savings Deposits	Real Income	Balance of Pay- ments	Real Broad Money	Domestic Credit
IMPACT	5	.837	0	0	4.097	2.990
DELAY	10	.278	.287	-0.004	.624	.468
INTERMEDIATE	15	.098	.397	-0.041	.260	.255
	20	.082	.157	-.043	.185	.213
LONG-RUN	36	3.690	8.212	-1.072	10.970	10.093

As expected, the impact multipliers indicate that the response is expansionary and direct. Following an increase in NFACB the money supply and domestic credit increase by 4.09 and 2.99 respectively, and these increases manifest themselves initially in an increase in total domestic spending. The long term multipliers are also relatively high for both these variables at 10.97 and 10.09

respectively. The reaction of the real sector is delayed and the multipliers tend to increase over time. As expected, the BOP deteriorated in the long run by 1.07 due to enhanced imports following the increase in NFACB. The results show that the impact of both domestic and foreign assets on the MB are of similar magnitude.

Next we considered the relative price of exports (XPFXPC) as an indirect policy measure that affects the system via MB. Although movements in international reserves are beyond the direct control of the Central Bank, this variable partly reflects exchange rate policy at a given point in time, since export prices can be made more attractive to the rest of the world through the depreciation of the Sri Lankan Rupee.

Table 7.4 indicates the delayed reaction on all aggregates. The long term impact on broad money is 7.6, while the volume of exports and real income produce longer term multiplier effects of 2.7 and 9.2 respectively. The positive impact of 0.49 on BOP in period 10 is offset in the longer term due to the reversal of the favourable effects of depreciation. The BOP records a marginal deterioration in the long run.

Table 7.4
A 10 per cent increase in the MB via a 10 per cent
increase in XPFXPC

	Period	Volume of Exports	Aggregate Price Level	Real Income	Balance of Pay- ments	Real Broad Money
IMPACT	5	0	0	0	0	0
DELAY	10	.607	0	.779	.498	.658
INTERMEDIATE	15	.003	.002	.577	-.082	.367
	20	0	0	.231	-0.064	.282
LONG-RUN	36	2.739	.019	9.178	-0.850	7.602

We shall now examine the direct effects of changes in policy instruments via mm. As expected, RR first affects the currency/deposit ratio and the excess reserve ratio and through them the mm and total reserves and the monetary variables. Table 7.5 indicates that the impact multiplier on broad money is 1.87 while the delay and intermediate multipliers are relatively small. In the long term broad money reduces by 5.18. This then reduces real income via (9) in the long run by 3.92. The intermediate and long run multipliers on the price level and BOP are insignificant at .012 and .40 respectively. Our model thus captures the effects of an increase in RR and enables us to trace through the transmission path from the monetary sector to the rest of the economy. This allows policy makers to select the appropriate level of statutory reserves required to reduce the credit creating capacity of banks.

Table 7.5
A 10 per cent increase in mm via a 10 per cent
increase in required reserves (RR).

	Period	Real Income	Balance of Pay- ments	Real Broad Money	Total Reser- ves	Aggregate Price level
IMPACT	5	0	0	-1.868	.488	0
DELAY	10	-.138	0	-.301	-.007	0
INTERMEDIATE	15	-.192	.02	-.125	-.002	-.001
	20	-.076	.02	-.089	-.003	0
LONG-RUN	36	-3.927	.40	-5.182	.350	-.012

It may however, be noted that the effect of RR is relatively small in magnitude when compared to the other measures that directly affect the MB. This confirms our historical observation that the MB is more influential than mm in Sri Lanka during the period under study.

We shall now consider the impact of interest rates (RST), an important policy variable, which indirectly affects both mm and MB. High interest rates are expected to discourage the demand for credit, and through this, reduce the credit creation capacity of the commercial banks.

The dynamic elasticities for a 10 per cent increase in RST on all variables are shown in Appendix 7.b. A summary table (table 7.6) is presented below.

Table 7.6

A 10 per cent increase in mm via 10 per cent increase in RST

	Period	Real Time and Savings Deposits	Aggregate Price Level	Real Income	Balance of Pay- ments	Real Broad Money
IMPACT	5	.182	0	0	0	-.108
DELAY	10	-.037	-.029	-.080	-.127	-.057
INTERMEDIATE	15	-.042	-.040	-.048	-.088	-.051
	20	-.022	-.017	-.034	-.068	-.030
LONG-RUN	36	.579	-.003	-1.068	-1.256	-1.195

As expected, the impact of an increase in RST is more direct on all monetary sector variables and indirect on real sector variables. The RST channel was able to trigger positive and immediate SE (.18) between money and interest bearing financial assets (time and savings deposits) and a cumulative effect of 0.58. This reduced broad money by 1.19 reflecting the restraining effects of an increased RST on monetary expansion. In the long run, the contractionary monetary effects are passed on to the real sector thus leading to reductions in the price level by .003 and real income by 1.07. In terms of credit creation the impact on mm is felt through increases in lending rates following the increase in deposit rates. The long term impact on the BOP at -1.26, however, is contrary to what was expected of an increase in RST. An examination of the dynamic elasticities on all variables (Appendix table 7.b) shows that the contrary impact of RST on the BOP is largely due to the specification of our exports equation

which is not affected by changes in RST. On the other hand, RST's impact on the volume of imports is too small (-.26) to exert any significant positive effects on the BOP.

7.1.2 Policy Scenarios

We shall now try to assess the impact of combined policies on the economy via MB and mm. In this experiment it is not possible to separate the impact on MB and mm, and therefore, we examine the total impact under each scenario. We consider policy options under three main scenarios: expansionary monetary policy, contractionary monetary policy and stabilisation policies.

Expansionary Policy Scenario

Within the expansionary monetary policy scenario there are several policy combinations. First, we assess the impact of a simultaneous increase in NFACB and a reduction in XPFXPC. Table 7.7 presents the results in Rs. million. The increase in NFACB directly raises the MB while the reduction in XPFXPC amounts to a depreciation of the exchange rate which is also expansionary on the MB via enhanced NFACB. As expected, the impact multiplier is valid only on broad money (Rs.1278 million) and is followed by a significant long term effect of Rs.3890 million and a similar reaction of Rs.3127 million in real income in the long run.

Table 7.7
A 10 per cent increase in NFACB and a 10 per cent
reduction in XPFXPC

	Period	Real Broad Money	Volume of Exports	Balance of Pay- ments	Aggregate Price Level	Real Income
IMPACT	5	1278.01	0	0	0	0
DELAY	10	235.14	37.65	29.64	.20	137.65
INTERMEDIATE	15	103.82	.18	-17.87	.44	159.12
	20	75.20	0	-17.24	.23	63.15
LONG-RUN	36	3890.29	169.82	-280.52	9.25	3127.84

Following the reduction in the foreign price of Sri Lankan exports via depreciation of the Rupee, the volume of exports increases in the long term by Rs.170 million. However, the favourable impact of enhanced exports is offset by the stronger effects of import rises, so that the BOP deteriorates by Rs. 280 million.

These results imply that this policy combination is beneficial for exports although it is difficult to sustain the favourable effects due to the stronger influence from imports, a common feature in small open economies. In other words, in export oriented small economies like Sri Lanka, more direct and stringent measures are needed to achieve BOP objectives and one would need to be cautious about placing too much reliance on exchange rate policy alone.

Our second combination involves a 10 per cent increase in IC and a 10 per cent reduction in RST. This

combination is expansionary on the money supply via mm although the immediate effect is a reduction of interest bearing monetary liabilities due to the effects of the reduction of RST. However, this effect is offset completely by the increase in import credit, probably due

Table 7.8
A 10 per cent increase in IC and a 10 per cent
reduction in RST

	Period	Real Time and Savings Deposits	Aggregate Price Level	Real Income	Balance of Pay- ments	Real Broad Money
IMPACT	5	-116.71	0	0	0	197.12
DELAY	10	-41.58	.15	62.48	-7.69	-52.28
INTERMEDIATE	15	11.25	.06	-41.37	-4.0	13.31
	20	1.35	.01	12.00	1.01	2.99
LONG-RUN	36	-117.47	1.09	-577.26	-362.49	517.98

to a leakage of credit following the enhancement of total liquidity in the system, reflected through the increase in broad money by Rs 518 million in the long run. Surprisingly, after positive delayed effects, real income declines by Rs.577 million in the long term. This may be due to increased imports which subsequently decline. This emphasizes the importance of increasing exports through supply side policies. As expected, the BOP deteriorates further by Rs. 362 million due to enhanced imports following the direct effects of an increase in import credit coupled with a reduction in the cost of credit via RST.

We considered another combination of expansionary policy measures which includes an increase in NCG and a reduction in lending rates (ZXY). The results are shown in table 7.9.

TABLE 7.9
A 10 per cent increase in NCG and a 10 per cent reduction in ZXY

	Period	Real Time and Savings Deposits	Aggregate Price Level	Real Income	Balance of Pay- ments	Real Broad Money
IMPACT	5	855.95	0	0	0	4423.17
DELAY	10	273.40	.623	283.18	- 3.92	614.19
INTERMEDIATE	15	96.91	1.05	389.52	-40.48	256.59
	20	80.91	.566	154.37	-41.78	182.29
LONG-RUN	36	3665.20	.717	8201.80	-1049.81	11195.88

The immediate impact of this combination is prominent on time and savings deposits and broad money which increase by Rs. 855 million and Rs. 4423 million respectively. With a delayed reaction real income increases by Rs. 8201 million while money growth is very expansionary at Rs. 11195 million in the long run. The consequent deteriorating effects on the BOP amounts to Rs 1049 million. Following the expansionary effects of money and real income, prices increase in the long run by 0.72.

Contractionary Policy Scenario

We shall now consider the contractionary policy scenario of an increase in RR and a reduction in XPFXPC. The former works via mm while the latter reflects the depreciation of the exchange rate. This policy combination is expected to provide strong BOP support.

Table 7.10

A 10 per cent increase in RR and 10 per cent reduction in XPFXPC

	Period	Real Broad Money	Real Income	Volume of Exports	Volume of Imports	Balance of Pay- ments
IMPACT	5	-407.14	0	0	0	0
DELAY	10	-24.68	18.31	37.65	-.59	31.29
INTERMEDIATE	15	-4.53	-5.96	.17	1.05	-73
	20	-1.98	-2.11	0	-.56	.57
LONG-RUN	36	-657.08	-285.87	169.82	-41.53	.13

As expected, the rise in RR reduces broad money by Rs.407 million in the immediate period and by Rs 657 million in the long run. Following this, real income falls by Rs 286 million in the long term. This captures the contractionary effects of this policy scenario fairly well. The contraction of imports (Rs 41 million) and the stronger positive effects on exports by Rs 170 million in the longer term provide BOP support, although the effects are marginal.

As seen from table 7.11, the contractionary impact of a 10 per cent increase in RST and a 10 per cent increase RR appears to bring about more powerful and direct effects via mm and MB. Accordingly, broad money reduces by Rs 567 million at the beginning and produces a cumulative effect of Rs 3427 million in the long term. Following the contraction in broad money, the delayed effects reduce real income by RS 2547 million in the long run. As expected, the BOP improves at all stages with a long term effect

Table 7.11
A 10 per cent increase in RST and a 10 per cent
increase in RR

	Period	Total Reserves	Real Broad Money	Real Income	Balance of Payments
IMPACT	5	97.32	-566.76	0	0
DELAY	10	-3.08	-188.52	-162.02	8.20
INTERMEDIATE	15	-2.45	-109.27	-113.35	19.15
	20	-2.35	-72.43	-69.41	15.35
LONG-RUN	36	15.27	-3427.14	-2547.09	360.54

of RS 360 million. A reduction in broad money helps to reduce liquidity in the system and correspondingly, improves the BOP.

Stabilisation Policy Scenario

The stabilisation policy scenario is used to strike a balance between expansionary and contractionary policies in Sri Lanka during this period. As explained in chapter 3 monetary management in Sri Lanka has been under

continuous pressure, largely because the fund requirements of the economy could not be provided through the budget. The enhancement of the MB via refinance funds (GCB) had to be arrested through an increase in RR, thus absorbing excess liquidity via a reduction in the mm.

Table 7.12
A 10 per cent Increase in GCB and 10 per cent
Increase in RST

	Period	Real Broad Money	Aggregate Price Level	Real Income	Balance of Payments
IMPACT	5	509.34	0	0	0
DELAY	10	- 18.83	-.19	-84.57	7.21
INTERMEDIATE	-15	- 38.95	-.17	- 5.15	7.91
	20	- 22.08	-.07	-27.00	3.62
LONG RUN	36	-488.81	-1.34	-325.53	67.52

A combination of a 10 per cent increase in GCB and a 10 per cent increase in RST is designed to reduce excess liquidity via the higher cost of credit so that the demand for non priority credit can be kept under control. Table 7.12 shows that the effects of RST have been more powerful and widespread on the system despite the enhancement of GCB. Although the initial impact raises broad money by Rs. 509 million, it tends to reduce it in the long run (Rs. 489 million). Following this, real income falls by Rs. 326 million along with a reduction in the aggregate price level (1.34). As expected, both variables improve the BOP in the long run (via a lower demand for funds due to the

higher cost of credit). This provides a means of implementing alternative policy scenarios to combat the expansionary effects of fiscal policy by using monetary tools. These results are similar to the combination of an increase in NCG and an increase in RR.

Another stabilisation policy package is aimed at providing concessionary credit to the private sector via GCB and absorbing part of the funds via high RR, thereby containing credit creating capacity of commercial banks. More specifically, we raised GCB and RR by 10 per cent. The impact of this combination is prominent on all monetary sector variables as shown in 7.13. Positive effects on MB are offset by the increase in RR raising the total reserves in the system by Rs 402 million. The immediate response of the money supply is an increase of Rs.336 million but it increases sharply to Rs 6024 million in the long run indicating more powerful effects of GCB via MB in the long term. Reacting to this policy combination, real income grows by Rs 4478 million in the long run. The delayed and the long run reaction on the BOP (Rs. 580 million) is contrary to a priori expectations and appears to have been dominated by the higher volume of imports. The impact on the price level is significant in the long run.

Table 7.13
A 10 per cent increase in GCB and a 10 per cent
increase in RR

	Period	Total Reserves	Aggregate Price Level	Real Income	Balance of Payments	Real Broad Money
IMPACT	5	401.82	0	0	0	335.91
DELAY	10	7.66	.344	155.70	-2.14	159.78
INTERMEDIATE	15	2.73	.586	215.14	-22.35	60.31
	20	3.33	.313	85.03	-23.16	67.71
LONG-RUN	36	510.91	14.07	4477.78	-580.42	6024.95

7.1.3 Impact of non-policy variables

As far as non policy variables are concerned, we first examined the impact on MB and mm of a 10 per cent rise in GOECD, representing the external demand for Sri Lankan exports. Table 7.14 shows, as expected, that the volume of exports would increase by a multiplier of 5.76 in the long run.

Table 7.14
A 10 per cent increase in GOECD

	Period	Volume of Exports	Balance of Payments	Total Real Expendi- ture	Real Income	Real Broad Money
IMPACT	5	0	0	0	0	0
DELAY	10	1.24	1.02	.362	1.61	1.38
INTERMEDIATE	15	.005	-.168	1.40	1.20	.76
	20	0	-.132	.613	.480	.59
LONG-RUN	36	5.76	1.83	16.51	19.18	15.83

Real income increases and as expected, the BOP outcome is favourable in the long run (1.8). Broad money and real expenditure also increase in the long run. These results can be interpreted as favourable effects from enhanced external demand.

Table 7.15
A 10 per cent increase in the price of imports (MPP)

	Period	Volume of Imports	Total Real Expen- diture	Aggregate Price Level	Real Income	Balance of Payments
IMPACT	5	40.91	0	0	-40.906	-22.498
DELAY	10	-3.130	-6.888	-.017	- 3.758	2.191
INTERMEDIATE	15	- .770	-5.302	-.018	- 4.532	.654
	20	- .647	-4.508	-.011	- 3.861	.647
LONG-RUN	36	16.023	-142.244	-.366	-158.267	- 1.950

Finally, we increased MPP by 10 per cent, representing a rise in the relative price of imports. As table 7.15 shows the immediate reaction on imports is positive although the delayed effects reduce imports in periods 10 and 15. A turn around is recorded in the long run thus increasing imports by Rs 16 million. As a result, the BOP deteriorates in the immediate period but improves in the interim period. The cumulative effect on the BOP however, is unfavourable. This may have been due to the feedback effects of increased income following the interim drop in imports which in turn raises the money supply in the long run. The reduction in the aggregate price level is marginal but the decrease in real income (Rs 158 million) is signif-

icant.

Overall, three important conclusions emerge from our policy analysis so far in this chapter. First, the impact on the MB via NCG, GCB and DOI produce similar results, although they differ in magnitude. Among the single policy instruments RST and RR appear to have more widespread effects on the macro economy. RR, in particular, helps in the achievement of BOP objectives, while RST reduces the total liquidity in the system via high cost of credit. Secondly, in the scenario analysis we observed similar results from an increase in RST and a reduction in XPFXPC; and an increase in RR and a reduction in XPFXPC. Finally, in both single and combined policy scenarios it is clear that of the two components of the money supply the effects via MB are more powerful than those via mm. This confirms the historical behaviour of these aggregates.

7.2 The Monetary Control Framework

In this section we highlight the importance of the establishment of a MCF for the implementation of monetary policy in Sri Lanka. 7.2.1 discusses the main features of, and the necessary conditions for, the formulation of a MCF. 7.2.2 analyses the implications of macro simulation models in general and our model in particular on the proposed MCF. In this section we also focus on the difficulties of constructing an MCF and implementing monetary

policy within the MCF in Sri Lanka.

7.2.1 Salient Features of the Proposed Monetary Control Framework.

Following from our discussion in chapter 3 we recommended the establishment of a MCF for Sri Lanka in order to improve monetary management in the future. We also recommended that it is advisable to embark on it sooner rather than later because of the primary role assigned to monetary policy in correcting macro economic imbalances associated with the present economic policy package. On the assumption that the authorities are in favour of a MCF we shall highlight main features of, and the necessary conditions for, such a MCF.

The MCF or the analytical framework for the money supply process should be relatively simple, easy to implement and based on sound and details of the behaviour of monetary aggregates. Our objective here is to understand the relationships among key macro economic variables, to set monetary targets, to monitor their behaviour and to use policy instruments in order to achieve pre-designed objectives of monetary policy. MSMs prepared on the basis of a priori expectations with emphasis on important institutional features would help to achieve these objectives.

The primary condition for a MCF is the choice of an appropriate definition of the money supply. The relation-

ship between the nominal stock of money on the one hand, prices, the BOP, and output on the other, is determined by the public's demand for money. The second condition is the estimation of the demand for money functions and the establishment of links between the supply and demand for money. A third condition is to test the stability of the money demand function. Fourthly, the MCF requires a set of forecasts at the policy making stage. These forecasts refer to the macro economy; the financial sector and the monetary base. The first category requires forecasts of GDP growth, investment, the BOP, the fiscal deficit and perhaps employment. The fifth condition is to select monetary targets (MTs) which are the means to achieve goals rather than ends in themselves. Hence, they are intermediate targets (ITs). The final condition is to establish relationships linking operating targets (OT) to ITs via mm and through this to the macro economy. (see Appendix 7.c).

In the section below we shall discuss briefly the actual formulation of the MCF and suggest a more practical approach in constructing the MCF and implementing monetary policy within that framework. Once the authorities are convinced that necessary conditions are adequate then they should concentrate on the selection of monetary targets which could take the form of single value or a range. However, too broad a range will make these targets less meaningful. It is also important to ensure that these targets can be brought back to the desired path within a

short time period if they deviate from it. For this purpose appropriate OTs would need to be selected through which ITs can be influenced effectively and quickly. The OTs should therefore, be closely linked to ITs and be under the direct control of the monetary authorities. Despite some practical difficulties associated with the control of the MB we consider MB as one of the most appropriate OT for Sri Lanka.

The next step is to gather prior knowledge of the likely performance of major macro economic aggregates. In Sri Lanka, forecasting GDP and fiscal deficits is difficult due to data constraints and frequent changes in revenue and expenditure estimates. Forecasts of the financial sector can be confined to narrow and broad money forecasts derived through money demand functions. Forecasting MB is difficult but is the most important component of the money supply process.

7.2.2 The Proposed Framework and the Implementation of the Monetary Policy.

Our model for Sri Lanka for the period 1977-1985 represents a tentative way to analyse money's interactions with the macro economy and channels through which it transmits monetary influences to the rest of the economy by using an explicit MSM. For example, in our model we saw how money feeds directly into total real expenditure and affects the price level. This in turn influences real income and, subsequently, the demand for money. In the context of

simulation, we also assessed the dynamic paths through which monetary impulses might be passed on to the rest of the macro economy. For example, a priori, the interest rate channel reduces the demand for currency and demand deposits and trigger substitution effect via increases in the demand for interest bearing assets. We also noticed the influence of domestic credit in this process and its role in offsetting the impact of interest rates. We further observed the transmission channel working via enhanced import credit which spills over into the BOP and hence on to external assets and broad money. These findings not only help to trace through the transmission channels of monetary policy, but also provide a clearer picture of the economy at a given point of time. Both the original SEACEN model and our own variation thus provide a convenient starting point for the establishment of MCFs in LDCs such as Sri Lanka.

Another important aspect of our empirical model was to emphasise the importance for the MCF of time lags and dynamic response. A particularly convenient tool in this respect was our use of dynamic multiplier analysis to assess the time lags involved before the respective endogenous variables reacted fully to policy variables (i.e. delay and long run multipliers). We also used sensitivity analysis to help to identify the most sensitive variables in our model.

Within the MCF it is necessary to choose ITs which can be controlled by OTs. ITs are broader aggregates such as M1, M2, DC and NFA. As far as the choice of OTs is concerned, in Sri Lanka the two major components of OT, i.e. NCG and NFACB are beyond the direct control of authorities. Hence, more effective policy instruments in these cases would be to conduct open market operations (OMO) and to absorb excess liquidity. This would, in actual fact, partly offset the expansionary impact of these variables. Our analysis in chapter 6 clearly indicated the instruments that can be used for OMO and their relative effectiveness. Alternatively, the mm could be controlled effectively through RR. Although much attention is not paid in this thesis to the exchange rate, this could be another key instrument to be considered. MSMs therefore, are useful as a means of selecting policy instruments to control OTs insofar as they enable the investigator to decompose both policy instruments and OTs in a formal manner.

In sum, it appears that MSMs and empirical models of the type we have used in this study can be used in conjunction with other tools to establish a MCF for an LDC such as Sri Lanka, although a more detailed model would be required than the one used in this study for accurate policymaking. At the moment Sri Lanka does not have any formal MCF which has surely constrained the implementation of effective monetary management.

Appendix Table 7.a

A 10 per cent increase in NCG on the Macro Economy
Dynamic Multipliers

Period		Variables													
		Real Curr- ency	Real Demand Depo- sits	Real Time & Savi- ngs Depo- sits	Total Reser- ves	Volume of Exports	Volume of Imports	Total Real Expen- diture	Aggre- gate Price Level	Real Inco- me	Balance of Pay- ments	Total Depo- sits	Real Broad Money	Domestic Credit	Capa- city
Impact	5	0	0	.812	.029	0	0	0	0	0	0	.592	4.200	3.066	0
Delay	10	.119	.107	.259	.013	0	.005	.274	.0006	.268	-.004	.274	.582	.436	.002
Interme- diate	15	.077	.014	.092	.005	0	.045	.414	.001	.369	-.038	.104	.243	.238	.003
	20	.043	.024	.077	.006	0	.030	.186	.0005	.146	-.039	.116	.173	.199	.001
Long Run	36	1.762	.700	3.472	.216	0	1.184	8.955	.418	7.771	-.994	4.200	10.614	9.688	.053

Appendix Table 7.b

A 10 per cent increase in RST on the Macro Economy
Dynamic Elasticities

Period		Variables													
		Real Curr- ency	Real Dema- nd De- posits	Real Time & Savi- ngs Depo- sits	Total Reser- ves	Volume of Exports	Volume of Imports	Total Real Expen- diture	Aggre- gate Price Level	Real Income of ments	Balance of Pay- ments	Total Depo- sits	Real Broad Money	Domestic Credit	Capa- city
Impact	5	-.337	-.256	.182	0	0	0	0	0	0	0	-.004	-.108	-.122	0
Delay	10	-.146	-.009	-.037	-.003	0	-.104	-.069	-.029	-.080	-.127	-.026	-.057	-.057	-.080
Interme- diate	15	-.127	-.018	-.042	-.005	0	-.018	-.047	-.040	-.048	-.088	-.033	-.051	-.042	-.048
	20	-.077	-.017	-.022	-.005	0	-.012	-.034	-.017	-.034	-.068	-.020	-.030	-.021	-.034
Long Run	36	-2.988	-1.008	.579	-.139	0	-.261	-.982	-.003	-1.068	-1.256	-.685	-1.195	-1.117	-1.068

APPENDIX 7.c

Linking Operating Targets and Intermediate Targets

The mm explains the behaviour of the money stock and its size depends on the definition of the money stock. Hence,

$$MB = C + R$$

Where C = public's demand for currency and R = bank demand for reserves and a relationship can be established as

$$C = cD$$

$$RR = rD$$

$$ER = eD$$

so that $MB = C + RR + ER = (c + r + e)D$ and

$$MS = C + D = (1 + c)D$$

where, RR = statutory reserves; ER = excess reserves;

c = currency/deposit ratio

Hence, total reserves,

$$R = MB - C$$

therefore,

$$MS = (1 + c)/(c + r + e) \cdot (NCG + NFACB + GCB + DOI + OINCB) = mm.MB$$

The reserve ratio r, and the bank's excess reserves e, then decide the level of deposits the bank reserves will create, which when added to c will give the equilibrium level of money.

CHAPTER 8

CONCLUSION

In this final chapter we bring together our main findings in the form of a conclusion and make some suggestions for further research.

8.1 Summary and Conclusions

This thesis analysed the relationship between money and the rest of the economy in Sri Lanka between 1977 and 1985, in order to identify the important paths through which monetary policy impulses were transmitted over this period. We also tried to highlight the role of macro-simulation as a useful tool for the analysis of the monetary transmission mechanism and to emphasise the importance of formulating monetary policy within an explicit monetary control framework. This is especially important in Sri Lanka since monetary policy has been regarded as a key instrument of demand management since 1977 and historically there has been a noticeable absence of an explicit monetary control framework.

In chapter 2 we set out the main theoretical underpinnings of a monetary control mechanism in the context of a brief review of the various theoretical expositions of different schools of monetary thought. These included Keynesians, monetarists, portfolio theorists and rational expectationists. An important conclusion here was

the empirical similarity of these viewpoints within the context of the MTM with the major disagreements revolving more around the range of assets to be included and technical relationships between financial and real assets, rather than any deep-seated theoretical disputes. It would seem appropriate, therefore, to construct a relatively simple aggregative model to help trace out the transmission mechanism in an empirical context, although some attention would need to be given to the neglected aspect of the impact of institutional change on the financial structure, especially that arising from financial innovation.

Chapter 3 was devoted to a historical review of monetary policy in Sri Lanka between 1950 and 1985. We noted the contrast between the period before 1977 when monetary policy had been characterised by intense administrative controls over the major economic variables and a suppression of market forces, and the much more liberal period after 1977. Monetary policy during the former period had essentially fallen in line with the administratively controlled economy and the major vehicle was selective credit controls based upon fixed and relatively low interest rates. During the later period, however, and largely as a consequence of growing monetary and price instability, monetary policy had ascribed to it a much more aggressive role than had hitherto been the case. In particular, the interest rate channel was emphasised rather than credit rationing or administrative controls. These reforms were

important because the more aggressive role assigned to monetary policy and the wider range of instruments used presented the authorities with unprecedented difficulties in economic management and the absence of an explicit framework for assessing the impact of monetary policy was felt throughout this period. Hence the need for a more explicit framework for assessing the impact of monetary policy and for a macro model which takes into account the institutional and policy changes introduced since 1977.

Chapter 4 was devoted to the construction and estimation of a small-scale quarterly aggregative 'monetarist' type macroeconomic model for Sri Lanka between 1977 and 1985, specifically to model the monetary transmission mechanism. Our review of previous empirical work in this area suggested that a modification of the general SEACEN framework for selected South East Asian countries would prove to be an appropriate starting-point for our work. The model consisting of 8 behavioural equations and 7 identities was estimated using both ordinary least squares and two stage least squares principal components and generally produced satisfactory results which conformed to a prior expectations. In contrast to the earlier SEACEN study, we found significant coefficients for interest rate variables in the money demand functions and managed to obtain better fits for the aggregate price level, real exports, and real imports.

In chapter 5 the model estimated in chapter 4 was subjected to dynamic simulation, both to validate the model and to calculate dynamic multipliers and elasticities relevant to the monetary transmission mechanism. In a simulation context the model performed well in terms of a range of evaluation criteria. As in previous studies, however, the balance of payments was a clear exception across the board. Sensitivity analysis also revealed some equations which could benefit from further work, but none of these tests suggested any serious cause for concern. Our ex-post simulation experiments provided further support for the SEACEN hypothesis about the transmission of monetary policy impulses and their impact upon the money supply, real income, the aggregate price level, and the balance of payments. In particular, the direct manipulation of reserve money via net domestic assets would seem to have a stronger impact on the economy than the manipulation of the money supply through the reserves of the commercial banks. When compared to the SEACEN Sri Lanka study, our simulations produce results which are similar in magnitude, but are more consistent with respect to sign over the sample period, reflecting the more complex lag structure employed in our model and changes in model specification.

In chapter 6 we used our simulation model explicitly to assess the relative importance of alternative monetary transmission channels. We found that the interest rate and credit rationing channels were especially important for

Sri Lanka over this period in addition to the dominating role of the money supply.

This model was then further used to carry out policy analysis, specifically to assess the relative impact of various policy instruments on a counterfactual basis with a view to including them within a future monetary control framework. These instruments were considered both as single instruments and in combination with others. Although such exercises should always be treated with caution given the well-known difficulties associated with macro-simulation, our experiments confirmed our earlier conclusion that instruments directed through the monetary base would tend to be more powerful than those aimed at the manipulation of the money multiplier. In addition, interest rates would appear to be a key policy variable and statutory reserve requirements are especially effective as far as the money multiplier is concerned. As expected of a developing country, the manipulation of export and import prices, such as through devaluation, would not appear to be an especially effective weapon as far as the balance of payments is concerned mainly due to the feedback effects of the change in imports via aggregate income and the money supply.

With respect to the monetary control framework, two general conclusions follow from our historical analysis of monetary policy in Sri Lanka and our empirical work. First,

given the complexity of the monetary transmission mechanism, it is essential to have a formalised analytical framework for carrying out monetary policy. Although the actual development of such a framework is beyond the scope of this thesis and would probably require a full optimum control theory approach, the absence of such a formal framework is apparent from the essentially ad hoc approach to monetary policy adopted by the Sri Lankan authorities since 1977. Secondly, we believe that our macro-simulation framework has been useful in identifying the type of mechanisms which would form an integral part of such a MCF. The 'monetarist' bias in the construction of our model and our dynamic simulation experiments have enabled us to assess the likely channels through which monetary impulses influence other variables in the macro-economy. Three such mechanisms relevant to the monetary control mechanism require further elaboration in this conclusion: the interest rate channel, the role of credit, and the role of the money supply in general.

As far as interest rates are concerned, in chapter 3 we noted that interest rates had been a key instrument of monetary policy after 1977. Moreover, when we attempted to identify important MTCs in chapter 6 we found interest rate's significance as a MTC, and our policy analysis in chapter 7 indicated the effectiveness of interest rates as a policy instrument. We therefore, feel that management of interest rate policy merits some comments which would be

helpful for future policy formulation. In view of Sri Lanka's commitment to open economic policies and liberalisation of the financial system, the freeing of interest rates is a necessary concomitant, as would be the removal of inconsistencies observed in the interest rate structure. We suggest first that the NSB should be allowed to decide its own interest rate structure according to market rates and its liquidity requirements. To facilitate this the subsidy given to the NSB should be gradually removed. Second, management of interest rates has to be viewed as a practical concept. On the one hand, ensuring positive interest rates is important in periods of high inflation but it should not be applicable to all situations uncritically regardless of the workings of the financial structure. On the other hand, by maintaining unrealistically high nominal rates Sri Lanka may deny herself the use of a potent instrument of policy. A rigid yardstick of high positive rates would mean manipulation of rates every time price changes occur. Finally, we stress that preferential interest rates and or subsidies should spring from the public sector or from foreign sources. This will allow interest rates to reflect market forces and equilibrium levels. The key principal is that total amount of subsidies would need to be limited to the extent of the availability of non inflationary funds. This view point is further supported by our simulation experiments which indicated that net credit to government and gross credit to commercial banks would enhance reserve money (MB) in the system

with adverse consequences on monetary and price stability.

As far as the credit rationing channel is concerned, we have found that CRE is a direct and powerful channel in transmitting monetary policy, although its impact has been marginal in Sri Lanka due to the relatively small fraction of credit on which ceilings were imposed and because part of CREs are expressed in terms of high interest rates. In addition, due to the administrative and discretionary nature of the implementation of SCCs in general and CRE in particular, we recommend that CRE should be used only to supplement traditional monetary policy instruments and that such measures should not be continued for longer periods because of distorting effects attached to them.

Finally, with respect to the money supply, a more comprehensive monetary aggregate would be helpful to analyse the impact of money's influence on the macro economy. The choice of an appropriate monetary aggregate is also essential for monetary targeting. Our research suggests that the narrow money supply is probably a better indicator of the inflationary situation than broad money. Nevertheless broad money is a more comprehensive measure since it reflects total liquidity in the system. An M3 derived from a financial survey would be more comprehensive but is not currently available on a regular basis.

8.2 Suggestions for Further Research

Aside from building upon the results established in this thesis to construct an explicit monetary control framework for the exercise of monetary policy in Sri Lanka, our main suggestions refer to ways of improving the empirical model.

To begin with, some attention might be turned towards the construction of an expected inflation variable to act as a proxy for the return on fixed assets in the money demand functions. Our attempts to construct such a variable proved to be unsuccessful. It may be the case that price expectations are unimportant in the context of Sri Lanka over this period, but equally it could be that a more rigorous testing procedure is required.

Secondly, there is room for improvement in the construction of the equation for the aggregate price level. Although we were able to improve on the results of the Sri Lanka SEACEN study, our estimated equation is still very simple. Since the price level and inflation are key features of the monetarist transmission mechanism, a fuller specification might be needed; including a more detailed testing of supply side effects. Our own experiments with an excess capacity variable (GAP) proved to be unsuccessful.

Thirdly, to use the model in a more policy oriented framework would probably require a more disaggregated

treatment of total expenditure, with a separation into government and private sector spending. The former might then be used as a policy variable. For data reasons, we were unable to carry out such a disaggregation in this thesis.

Fourthly, it would be highly desirable in a more detailed model to utilise data compiled from a full financial survey, containing a comprehensive statement of important macro aggregates. Within the monetary survey one can only assess a part of the total picture.

Finally, since many of the important conclusions from our simulation experiments depend upon the correct specification and stability of the important parameters in the model, one would wish to expose our prototype model to a full econometric evaluation along the lines of Hendry's (1985) PC-Give. Then, if necessary, adjustments could be made to ensure greater confidence in the forecasting properties of the model. Given the resources available to us and the size of the model, we were only able to carry out a partial and often ad hoc assessment of these equations. Nonetheless, we hope that our work will contribute both to the understanding of the monetary transmission in Sri Lanka and to the construction of an explicit framework for a monetary control framework.

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